



Kribi Power Development Company

Dibamba Power Project 88MW Thermal Power Plant & 90kV Transmission Line

**Environmental and Social Impact Assessment
Final**

January 2008

Executive Summary

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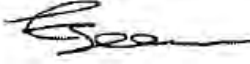
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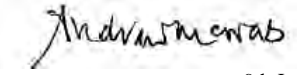
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ABBREVIATIONS

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
HFO	Heavy Fuel Oil
ICNIRP	International Commission on Non-Ionising Radiation Protection
IFC	International Finance Corporation
IUCN	International Union for the Conservation of Nature and Natural Resources
NGOs	Non Governmental Organisations
PPA	Power Purchasing Agreement
RAP	Resettlement Action Plan
SIA	Social Impact Assessment
SIG	Southern Interconnected Grid
SMP	Social Management Plan
STI	Sexually Transmitted Infection
SW	Scott Wilson
WHO	World Health Organisation

EXECUTIVE SUMMARY

1 INTRODUCTION

AES Sonel, the national power utility company in Cameroon, is currently developing the Dibamba Power Project in order to meet the requirements of electricity generation in Cameroon and to reduce the occurrence of temporary electricity cuts when electricity demand is high (load shedding).

The Project will be located approximately 20km to the east of Douala in the Littoral Province (see Figure ES-1). The Dibamba Power Project comprises the construction of a 88MW power plant fuelled with Heavy Fuel Oil (HFO) and the erection of a 90kV transmission line between the plant and the existing Ngodi-Bekoko 90kV substation at Bekoko 2km to the west of the plant site. The Heavy Fuel Oil will be transported by road from the Limbe Oil Refinery located approximately 120km west of Dibamba.

The Dibamba Power Project will be owned by AES Corporation and the Government of Cameroon through a subsidiary called the Kribi Power Development Company (KPDC). All the electricity produced will be delivered to the Southern Interconnected Grid (SIG) and sold to AES Sonel through a Tolling Agreement.

In line with the requirements of the Ministry of Environment and Protection of Nature, AES Sonel commissioned Scott Wilson (SW), an international environmental and engineering³ consultancy, to undertake the Environmental and Social Impact Assessment (ESIA) for the Dibamba Power Project. In turn SW partnered with Safex, a local Cameroonian consultancy.

The ESIA reports have been prepared in accordance with legislation of Cameroon and internationally recognised guidance and standards as adopted by the World Bank and International Financial Corporation (IFC). The Dibamba Power Project is classed as a Category B Project under the IFC Project Categories and Category 1 under African Development Bank guidance.

The overall methodology adopted for undertaking the Dibamba Power Project ESIA has been based on the requirements of Cameroonian Legislation as set out in the EIA Decree N° 2005/0577 of 23rd February 2005 and international best practice, including IFC Performance Standards, IFC Environmental, Health and Safety Guidelines and World Bank Operational Policy (OP) 4.01. The key stages, which are not independent but in many instances have been undertaken in conjunction, are:

- Scoping exercise;
- Field Visits;
- Identification of appropriate Cameroon legislation and guidelines;
- Consultations;
- Baseline Data gathering;
- Impact identification and assessment;

¹¹ Environmental and Social Impact Assessment (ESIA) is a process used to investigate the potential implications of a project on the environment and community.

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- Mitigation measures identified; and
- Environmental and Social Management.

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 same as EIA);
- Section 7 - Environmental Management Plan; and
- Section 8 - 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 IFC and African Development Bank. Consequently this report has been prepared with reference to World Bank, IFC guidance and the African Development Bank, where relevant.

Before this project can proceed it must first be approved by the Ministry of Environment and Nature Protection and the Interministerial Committee of the Environment (ICE) and obtain an Environmental Conformity Certificate.

3 THE PROJECT

3.1 NEED FOR THE PROJECT

The electricity infrastructure of Cameroon is dominated by the Southern Interconnected Grid (SIG). 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

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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 low water levels and flow rates are putting additional strain on the already overburdened electricity system. The 150MW Kribi Power Plant, currently scheduled for commissioning in early 2010, is proposed to help meet the growing need. However, the 88MW Dibamba Thermal Power Project is proposed for emergency peaking and back-up capacity to alleviate load shedding in the dry season caused by (i) growing demand; (ii) insufficient thermal capacity to enable optimal water resource management; and (iii) delays in the construction of the Kribi gas-fired power project.

3.2 PROJECT SETTING

The entire project will be located in the equatorial region of Cameroon within the Littoral Province (see Figure ES-1). The power plant and transmission line will be located in Yassa (see Figure ES-2 and ES-3), a village situated approximately 20km east Douala.

The project is entirely within the coastal lowlands of western Cameroon (see Figures ES-1 and ES-2). The project area is primarily within the lowland hills with a rural landscape of disturbed agricultural land, fallow and shrub habitats. The topography is one of low rolling hills or hillocks and shallow valleys. There is little natural forest vegetation remaining. The average temperatures are about 28°C, average annual rainfall in the area is also high at approximately 4,000mm. The Dibamba River lies approximately 2km east of the project area. At present a groundwater survey has not been completed so the precise depth and quality are unknown.

The predominant economic activity within the project area is subsistence agriculture. Due to the poor nutrient status of soils such agriculture tends to be used for shifting agricultural and soils need artificial fertiliser if permanent farming is to be practised.

3.3 PROJECT DESCRIPTION

The Dibamba Thermal Power Project comprises of the following components:

- The construction of a 88MW power plant fuelled with heavy fuel oil (HFO) at the site in Yassa village; and
- The construction of energy transmission facilities, including:
 - (i) A step-up substation at the plant site (11 to 90kV) at the plant site; and
 - (ii) A 1.8km 90kV double circuit transmission line between the plant and a connection to existing 90kV transmission lines which run to Ngodi-Bekoko substation at Bekoko.

The power plant equipment is being provided by Wärtsilä whilst the substation and transmission lines EPC contractor is still to be approved.

3.3.1 The Power Station

The Site

The proposed power station site at Yassa is located close to the main Douala-Edéa road, in the Douala III subdivision. The plant itself will occupy 4 hectares (ha) within an overall area of approximately 7.7ha, which will allow the development of the construction compound for the project and act as a buffer of land to best reduce the potential impacts. An office building, welfare facilities, workshops and stores will also be constructed at the plant site.

The land on site is gently sloping to the south east and varies in height from approximately 45m to 57m above sea level. The site is predominantly agricultural plantings, old fallow (covered with pioneer vegetation), and regenerating secondary scrub but no true forest or trees of significant size. There are no buildings or structures on the site.

A stream, which flows throughout the year, flows to the east of the plant site. Effluent from a soap factory, immediately north of the plant site, is a source for this stream. The stream is used by local inhabitants as a water supply.

Access Road

The plant site is located along the Douala-Edéa main road, which is fully tarred and in general in good condition. This road has a minimum carriageway width of 7m and surfaced verges of up to 1m. Current traffic volumes are relatively low (see Section 5.5). There is a need to construct a new access road from the main road to the plant site. This will involve the upgrading of an existing dirt track to a 9m by 800m tarmac road.

Power Station Equipment

The power plant will involve the installation of eight 11MW engines (total output 88MW). The engines will be grouped in two sets of four and housed in separate power houses. The eight generators will have individual emission stacks grouped into two sets of four. The stacks will be 40m tall.

The plant will burn heavy fuel oil (HFO) as the main source, supplied by road tankers from the oil refinery at Limbe, approximately 120km away. Approximately 12 road tankers are anticipated per day during peak operating conditions of the plant. On-site storage tank capacity for HFO is based on running the plant for 14 days at full capacity.

Step-up Substation

A step-up substation equipped with 11/90kV power transformers will be installed to enable power to be exported from the site via a new 90kV transmission line, connecting to an existing 90kV line which runs to the Ngodi-Bekoko substation at Bekoko.

At the Ngodi-Bekoko substation at Bekoko, new 90kV bays will be added to connect the new line to the existing grid. No new land take is required here as sufficient space is available within the existing substation site.

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Ancillary Buildings

The plant site will also include a utility house, this building will contain within it offices, control room, switchgear room, canteen, staff changing and welfare facilities, and separate workshop and warehouse.

Load Demand

The peak daily load demand on the SIG occurs between 1800 hrs to 2200 hrs. On a seasonal basis the main load period is the dry season, from January to June, with lower demand during the rains (July to December). It is currently envisaged that the following operating scenario as outlined below will occur.

Table E-1: Power Plant Load Profile		
Season (months)	Number of Engines Operating at 100%	
	1700-2300	2300-1700
Dry (January – June)	8	2
Rainy (July – December)	4	1

The Transmission Line

The transmission line will be approximately 1.8km in length. The line will be constructed within a corridor (wayleave), which will be a total width of 30m, i.e. 15m each side of the line axis.

The towers to be used will range from 29-36m in height depending on the topography. The nominal spacing of the towers will be 100m, although this may vary from 100-300m depending upon the terrain. The line will be double circuit.

The new transmission line will follow an east to west orientation running parallel to the main Douala-Edéa road, on its south side. From leaving the power station the route runs alongside a dirt track, the route subsequently doglegs north to avoid residential properties where it continues west where it crosses the main road to the south of Yassa junction. Access to the majority of the line corridor will therefore be easily undertaken from minor trackways and the main road.

Predominantly the selected route passes through subsistence agriculture, fallow land, and regenerating secondary scrub. Fallow areas are generally covered with pioneer vegetation. The area is sparsely inhabited, and this route was selected to avoid, as much as possible, crossing the residences in the village.

Construction Phase

The construction phase for the whole project will be approximately 15 months, over two phases. Firstly, preparation of the site, installation of all ancillary equipment and structures,

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transmission line and four generators, anticipated to be complete by mid 2008. Secondly, installation of a further four generators, anticipated by early 2009.

During the construction phase employment levels will vary but are anticipated to peak at around 480 workers. These will range from manual labourers, through electrical, mechanical and civil technicians and engineers, to site managers.

For the construction phase all main plant and equipment will be imported via the port at Douala, and transported to the site by the Douala-Edéa road. Cement and other manufactured construction materials will be sourced from Douala.

Operational Phase

During operation of the power station approximately 34 specialised staff, mainly engineers and technicians will be employed to ensure the power station operates 24 hours/day. Non-specialised staff include security personnel and cleaners and will be employed locally.

Douala is only 20km west of the site and therefore no staff housing will be provided at the plant site.

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 2m 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.

During the operational phase, growing of low-level crops and grazing by stock will be permitted 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.

Decommissioning

The design life of the plant is 25 years whilst the transmission line has a typical lifespan of 50 years.

3.4 CONSIDERATION OF PROJECT ALTERNATIVES

3.4.1 Plant alternatives

Studies of alternative options for providing the load requirements were carried out in 2006 and 2007 by AES Sonel. These studies considered alternatives to locations, plant types, fuels, transmission line route and cabling. The conclusion of the study was that a thermal power plant located at Dibamba and equipped with eight 18V46 Wartsila engines fuelled

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with HFO 180 supplied from Limbe was the most economic, environmentally and socially viable option.

3.4.2 Plant Site

Eight sites were assessed with respect to real estate, environmental constraints (particularly noise and air quality), interconnection, site access (equipment unloading, fuel and personnel access), fuel delivery and storage, and water availability. The conclusion of the survey was that Dibamba was the preferred site and the best option as it was near to the Nogodi-Bekoko Substation.

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.

4 SCOPING AND CONSULTATION

4.1 SCOPING

Environmental and social impact scoping work was undertaken during and following visits to the site by the study team in August and September 2007. The site visits included discussion with the Ministry of Environment and Nature Protection, other relevant Ministry offices in Douala, AES Sonel's staff and project team members to ensure all available existing baseline data was collated.

4.2 CONSULTATION

Consultation for the ESIA has also been undertaken in accordance with the requirements of the EIA Decree of Cameroon 2005 / 0577.

In addition, as this is a Category B Project (IFC 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 make the draft ESIA report available in a public place that is convenient to the affected groups and local NGOs.

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 5.12 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 power station. Sources of emissions are the nearby Douala-Edéa main road and domestic emissions. Due to the low volumes of traffic and limited housing in the area both sources are regarded as moderate and insignificant contributors, respectively, in terms of effects on baseline air quality. The transmission line crosses mainly rural land. Domestic emissions are unlikely to be significant due to there being only scattered residences in the vicinity. There is one existing industrial development in the vicinity of the proposed power plant, the Savonnerie Azur soap factory, which is adjacent to the site directly to the north.

As there are no formal air quality monitoring stations within Cameroon, there were no readily available existing baseline data on the project area. A 3-month monitoring survey using diffusion tubes, commencing in November 2007, to measure background levels of Nitrogen Dioxide (NO₂) and Sulphur Dioxide (SO₂), and ozone (O₃). The results of the survey will be incorporated into the ESIA. In the absence of local background data, data from a typical rural site 120km to the south was utilised from 2006. Results showed that current levels of NO₂ and SO₂ are far below World Bank guideline values and ozone levels are typical of equatorial latitudes. Overall, baseline air quality in the vicinity of the proposed plant site and transmission line route can be considered to be good.

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 of short duration and not significant.

During the operational phase, the potential impact is associated with emissions from the power plant. The impacts were fully modelled using air dispersion software and were assessed as being long-term and adverse, but of minor significance. World Bank Air Quality Guideline Values will be met.

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.

5.4 NOISE

To establish existing noise levels around the plant site, a baseline noise survey of at least 24 and 48 hours were undertaken in September 2007 at two locations. Close to the nearest dwelling monitoring results show little variation between day and night periods. During the day, the dominant noise sources include traffic, noise produced by the existing soap factory, and insect noise.

Potential noise impacts from the Dibamba 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 engines during the operational phase. Traffic noise for both phases is assessed as being insignificant.

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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; and
- Controlling and limiting traffic movements around sites.

All noise generated in the construction phase is short-term and of minor significance.

Mitigation measures have been devised to protect local residents. These include construction of a noise bund (earth or similar), or stepping of the site, 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.

Predicted levels as a result of certain operational circumstances of the power station exceed WHO recommended guidelines at the closest receptor location. However, comparison with the existing measured levels indicates that current levels in this location exceed both the WHO guidelines and operational predictions. Given the predicted cumulative impact with the neighbouring soap factory resulting in an increase of 1dB, the impact of operational noise is considered negligible.

5.5 TRANSPORT

The main transport routes associated with the carriage of people and goods to/from the proposed Dibamba plant site during construction and operation will primarily involve the main road (RN3) between Dibamba-Douala (20km) and between Douala-Limbe (100km), respectively. The RN3 is part of the main route from the major port at Douala to the capital Yaoundé where it connects with 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 carrying a large number of HGV movements. Materials and equipment are to be transported to the site, via road, from Douala Port during construction, fuel required for operation of the power station will be sourced, via road, from the oil refinery in Limbe. Access to the plant site will be by a track, 800m in length, which will be tarmaced for the proposed development.

Baseline data for traffic flows have been taken from published information. The 2005 and 2007 data shows that overall traffic volumes on the Douala-Edéa road are moderately high by Cameroonian standards with between 3,000 to 4,500 vehicle movements per day. Published 2003 data on the Bekoko-Limbe segment of the route show levels to be relatively high in the context of the expected daily profile in Cameroon.

Potential traffic impacts from the power project include increased road traffic and increased safety risks.

During the construction phase traffic will be generated from a series of activities including, site clearance, construction of access road, installation of plant and equipment, and

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construction of the transmission line. At the peak working phase, total traffic movements generated by the development are likely to be in the order of 30 to 40 movements per day. These transport movements will be associated with importing material and labour. At the peak, a total of 48 daily two-way movements would be generated for movement of labour.

During operation requirements for fuel will be approximately 12 road tanker movements per day from Limbe. Staff will work on a shift basis and be transported to the site from Douala and the surrounding area. Overall, the traffic flow during the operational phase is very low and will have no significant impact on the environment.

The proposed project will generate additional traffic movements on this section of road resulting in an approximate 1.2% increase over current volumes for the peak period of the construction programme. Well below accepted guidelines (30%) from which significant impacts may be caused (Institute of Environmental Assessment (IEA), Guidelines for the Environmental Assessment of Road Traffic, UK, 1993). Overall traffic movements on this road will still be low in comparison to its potential design capacity.

Proposed mitigation measures will deal the potential problem of congestion and risk of accidents, include route management, such as route selection, hours of use; planned convoys; staff transport; driver training; vehicle maintenance; signage and consultation.

In summary, the main effects of the project will only occur during the peak construction phase and during peak hours. The overall impact is therefore predicted to be insignificant. During operation, a small number of workers and HGVs are associated with operating the power plant and no impacts are predicted to occur.

5.6 WATER RESOURCES

The Dibamba area lies within the central coastal region of Cameroon characterised by the 'Maritime Cameroon' type climate. Rainfall is extremely prevalent during July-December rainy season peaking October. The annual average rainfall is approximately 4000mm. The area has relatively low-lying shallow valleys forming tributaries of the Dibamba River, the major watercourse of the area. The Dibamba River lies too far from the site to be impacted. Generally the ground conditions allow a degree of rainfall infiltration and probably account for the general lack of locally-sourced surface water features in the plant site area. The soap factory, to the north of the site, was observed to produce an effluent stream which is channelled northwards, downhill to the main Douala-Edéa road. The stream was observed to function as an informal local water supply to a number of dwellings alongside. In the wider area the majority of inhabitants draw their water from a local borehole source.

There is no information regarding the presence of an aquifer although it has been assumed that one exists within the area of the site. At present a groundwater survey has not been completed so the depth and quality are unknown. AES Sonel anticipate that a borehole in the region of 80m below ground level will be required. Water quality samples are to be undertaken of the effluent stream and boreholes.

During construction potable water will not be available locally and must be brought in by tanker. Non-potable water, required during construction, will be sourced from on-site boreholes. During operation of the plant and staffing facilities, including potable water, water from the boreholes will be treated and utilised.

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Mitigation measures to minimise the potential contamination of surrounding watercourses and groundwater are identified and included within the Environmental Management Plan framework, see Section 7.

Overall, the potential impact upon groundwater resources, both in terms of resource availability and quality, has greater significance than for surface water. This is largely due to the absence of any local surface water receptor which could easily be linked to the power plant development (pathway).

However, there is likely to be a groundwater resource (aquifer) of some size beneath the site. Aside from the intrinsic requirement to ensure that it is not adversely affected, other local users almost certainly use the aquifer.

The overall assessment of impact has concluded that the majority of effects are minor or insignificant. No significant impacts are expected as a consequence of the transmission line construction or operation.

5.7 LANDSCAPE AND VISUAL

The project area is located within the coastal lowlands of southwest, which consist of flat alluvial coastal plains with mangrove and forest cover leading into slightly higher, gently undulating, lowland hills. The project area itself is primarily within the lowland hills with a rural landscape of highly disturbed, fallow land and scrub. This dominates the landscape character of the area with settlement and agricultural clearings being secondary landscape features.

The general landscape character is one of low ecological value, on gently rolling low hills interspersed with human settlements, subsistence farming and a main road and power lines. The soap factory to the north of the site dominates views around the plant site.

The project does not involve any major remodelling of the landscape, the main impacts on the landscape character being only the introduction of an additional transmission line adjacent to the existing road corridor and the construction of the plant. The plant site is not an entirely new form of development within the existing setting with the soap factory located immediately to the north of the plant site.

The route selection for the transmission line has been modified, where practical, to provide the maximum separation distance to existing residences so as to reduce visual intrusion as well as avoid property and cultivated land. At the plant site, the location of the actual power plant within the overall plant site has been selected to maximise, where possible the separation distance to the properties in the area and the main road, and enables a vegetation belt to re-establish during operation. Bunding and stepping of the site is also being considered to reduce visual impacts.

The main element that will be visible will be the 8 emission stacks of 40m high, which will therefore be visible from both nearby properties and longer distance receptors. However, these will form only a small proportion of the views, only dominating local views, which will be partly reduced through the measures described above. Mitigation includes allowing re-vegetation on site in the disused areas and painting of the stacks regularly the same or similar colour as the sky. Landscape and visual impacts are assessed as long-term and adverse but of minor significance.

5.8 LAND USE

The baseline conditions within the project area were established through on-site observations. Land use has been recorded as part of a topographical survey undertaken of the project area by AES Sonel in 2007, and census commission survey of the plant site and transmission line corridor in November/December 2007.

The primary impacts on land use are associated with the need for land take from the plant site and the clearance of vegetation from the plant site and the transmission line corridor. Impacts arise in both construction and operational phases and most changes will be permanent in nature.

Direct land take for the construction will be approximately 7.7ha at the plant site which will include an area for temporary construction compound and approximately 0.04ha on the transmission line corridor for the foundations of the tower bases. During the operational phase direct land take for the plant will be approximately 4ha as the construction compound will be restored. However the total area of approximately 7.7ha 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 7.7ha will therefore be lost. The total land required for the 90kV wayleave will be approximately 5.4ha 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.

5.9 ECOLOGY

The plant site and the associated transmission line corridor are both situated within highly disturbed agricultural, fallow and scrub habitats along the corridor of the Douala-Edéa road about 2km west of the Dibamba River. To confirm the status of the project area, particularly in relation to any relict forest species that might be present, baseline ecological surveys were undertaken in November 2007. There are no true forests or trees of significant size within the project area. Fallow areas are generally covered with pioneer vegetation and have a low conservation value. Sensitive plants have generally been destroyed by slash and burn agricultural systems. Perennial crops like Pineapple, Avocado, Papaw, Palm Oil, Macabo, Manioc, Potato, Yam, Dolè, Groundnut, Banana and Plantain are grown by the local farmers.

Those species recorded (81 in total) generally have very large distribution in Africa. The four vulnerable species are *Rauvolfia vomitoria*, *Pentadiplandra brazzeana*, *Senna alata* and *Alstonia boonei* and all are medicinal plants.

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A total of 47 bird species were recorded during the survey. The bird species recorded during the survey are mainly characteristic of agricultural areas and secondary growth, and are common and widespread both locally and in West Africa. The only bird species of conservation concern recorded during the surveys is the grey parrot (*Psittacus erithacus*) which is listed by the IUCN as Vulnerable. Almost all of the birds recorded actively colonise opened areas in forests, secondary growth and agricultural areas. The conservation value of this bird community is low.

No mammals were recorded during the survey, and the mammal community is likely to be restricted to small rodents.

Potential impacts on the flora and fauna are:

- Permanent loss of existing habitats and related biodiversity due to land clearance for construction;
- Loss or alteration of habitat types due to clearance for the transmission line wayleave;
- Habitat severance due to clearance of the 30m wayleave; and
- Disturbance of wildlife and potential increase in road kills, etc. due to project construction and operation activities.

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 2m height where practicable), control of noise during construction and at the plant site during operation, and vehicle speeds.

Whilst the development will result in the loss and alteration of this habitat, and has the potential to cause disturbance to wildlife, the overall area of impact is relatively low and due to the current level of disturbance within the area, overall impacts are minor.

5.10 CULTURAL HERITAGE

The baseline conditions of cultural heritage and archaeological potential of the project area were identified by a site survey involving observation of open sites and geotechnical borehole samples (the transmission line route has not been surveyed). The survey identified three zones containing archaeological remains dating from the prehistoric period. In particular, the presence of ceramics buried up to 1.50 m below ground level may indicate an early settlement buried at the site. It is not known at present whether the remains are likely to be of local, regional, or national value.

No sites of cultural and/or spiritual significance were identified on or in the immediate vicinity of the site. There are no national legally protected cultural heritage areas/buildings on the site and in the surrounding areas.

Primarily potential impacts will only be associated with the construction of the power station, principally through site levelling and foundation excavations.

In order to confirm the presence or absence of deposits of regional or higher archaeological value, further monitoring surveys should be undertaken to confirm the presence of such deposits. It is considered that further investigation works can be undertaken in parallel with

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commencement of works provided appropriate on-site best practice measures are implemented. Mitigated impacts will be long term, adverse but not significant.

5.11 SOILS

The baseline conditions within the project area were established by reference to published materials (Bernard, Yerima and Van Ransy 2005). Additional information on site-specific sub-surface ground conditions for the project area was obtained from the geotechnical investigation undertaken on behalf of AES Sonel. The entire project area is classified as being within the Haplic Ferralsols soil group associated with humic gley soils. These soils are physically stable and well structured giving good drainage characteristics with relatively high permeabilities. Due to the poor nutrient status, soils tend to be used for shifting agricultural uses and need artificial fertiliser if permanent farming is to be practised.

The primary impacts on soils arise from existing contamination associated with the soap factory to the north. Secondary impacts can also arise from the disturbance of soils and vegetation, leading to erosion. Spillage of oils and other potentially polluting substances during construction and operation may also lead to ground contamination.

During construction the volumes of fuels and oils on-site will be relatively low as bulk storage is not required. The main potential impact of the project involves bulk storage of HFO, LFO, transferring and processing of fuel-oil at the power station during its operation. However, control systems for bulk fuel-oil storage and handling are in common use throughout the world and other AES Sonel power stations and if correctly managed are effective at preventing spillage to the environment. Spillage or leakage may cause localised soil and / or groundwater contamination; the clean-up or remediation is dependent upon the quantity involved and the future uses of the area, these will be detailed in the EMP. In addition basic measures such as placing tanks / or drums within concrete bunds or containment of any stored materials so as to stop direct discharge to the environment should be implemented. The overall impacts arising from the project due to soil and / or groundwater contamination will be reduced such that the impacts are not significant.

5.12 WASTE

The current levels of waste on site were established through site visits. The plant site and transmission line corridor are predominantly scrub and subsistence agriculture. From visual inspections there seemed to be no waste dumped on the site.

Potential impacts on waste arisings will be associated with:

- Vegetation waste from site clearance;
- Spoil from groundworks, including site levelling, landscaping, backfilling;
- Construction wastes, including excess materials, temporary structures and staff wastes (domestic and sewage);
- Operational waste arisings - sludge and water from oily water treatment, water from the site drainage system; domestic waste; sewage waste; and commercial office wastes;
- Vegetation from wayleave management; and
- Decommissioning wastes.

Mitigation measures will require the planning and management of materials during construction, operation and decommissioning to reduce the volume and types of waste arising, and to promote the waste hierarchy (reduce, reuse, recycle, recover, landfill). A waste management plan should be drawn up and implemented for each phase.

6 SOCIAL IMPACT ASSESSMENT

6.1 INTRODUCTION

The following section is based on the outcome of the scoping exercise, site visit, a household survey carried out in March 2006 for a similar project in the same province (Kribi Power Project, Mpolongwé, Scott Wilson 2006), public consultations, focus groups and a detailed sample household survey of the project area conducted in November 2007.

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 and focus groups were carried out by Scott Wilson with assistance from Safex, the local consultant, in November 2007 to capture up to date project-relevant information and to provide an accurate baseline against which the significant potential impacts could be measured.

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

6.3 POPULATION AND DEMOGRAPHICS

The project area is located in the Littoral Province. Eighty-two per cent of the Littoral's population are urban dwellers. The majority of the urban population can be found in Douala City. This population is very young with the average age being 21.9 years and 50% of the population is under 15 years old.

Independent of the SIA and in line with Cameroonian legislation, a full land and property census was undertaken by the Compensation Commission (in November 2007) established by the Littoral Divisional Officers, as specified by the Public Utility Decrees signed by the Minister of State Property and Land Tenure for the project (in November 2007). Initial findings of the census indicate the following are within land take required by the project and will therefore need to be resettled:

- 54 crop fields (belonging to 47 individuals⁴);
- 3 Buildings (one place of residence, one property under construction and one disused timber storage facility);

⁴ The corresponding number of households will be confirmed during the Resettlement Action Plan stage.

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- 0 graves; and
- 25 titled lands (12 belonging to 10 individuals and 13 belonging to 6 companies/associations)

There are no households at the plant site and only 3 properties in the vicinity of the wayleave, which will be directly affected. Up to 47 households will lose access to the land they currently farm that is within the project area and 2 households will lose their houses and one business will lose its storage infrastructure.

Land requisition along the corridor of the transmission line is potentially the most important 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. Seven alternative plant sites were reviewed and the preferred land-based site was chosen to minimise the need for resettlement. The transmission line route was also selected to avoid residential properties as far as possible.

For the 3 residences requiring resettlement, it will be mitigated by a Resettlement Action Plan (RAP) that will be drafted in compliance with requirements of the World Bank Operating Policy 4.12 and IFC Performance Standard 5. 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.

In-migration will primarily be in the construction phase when there will be a maximum of 480 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 up to 480 people is assessed as adverse and significant.

6.4 ECONOMIC ENVIRONMENT

The project area is characterised by moderate to severe poverty. Many people in the area lived by subsistence farming or informal sporadic roadside business activities. The main sources of income in the project area were, in descending order of importance, informal sector (48%) of which agriculture was 34% and commerce 14%, the formal sector provided 33% of the main employment in various forms from drivers to working in the government and AES Sonel to construction workers such as carpenter and builders. 19% of the members of the household were unemployed.

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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 and IFC Performance Standard 5 guidelines and will focus on providing full and appropriate redress for any economic loss suffered by the project affected people.

Overall, the impacts will be positive during a limited period of time on the local population despite some minor negative impacts that can be mitigated through good compensation strategies and information and sensitisation campaigns. At the national level, the impacts will be positive during a longer period.

6.5 SOCIAL SERVICES AND INFRASTRUCTURE

There are a number of primary schools in the Douala III subdivision but very few in Yassa village itself. None are understood to be currently located within the land required for the project. Literacy in the project area is also high, which was supported by the findings of the household survey undertaken. The most common health facilities used by the local population were the Leproseries of Dibamba, Health Centre of Barcelone, Health Centre of Ndogpassi, Health Centre of Japoma and Health Centre of Oyack, however most of the interviewed households identified the local hospital as their local treatment centre.

The Yassa village has access to the main primary road (tarred) that connects the Littoral Province to the South province as well as many other secondary untarred roads which connect it to the other villages. However, as very few people own or have access to private cars or motorbikes, the roads are used mainly for walking or 'hitching a ride' to Douala or Edéa.

The main source of water in the project area is boreholes followed by a tap in the yard, well in the yard, and tap in the house. There are several borehole locations identified by the local population, including a Sawawa borehole, MAG borehole, community borehole, and other company boreholes.

Communication via radio is the main source of information in the project area. In addition, the majority of households surveyed had mobile phones.

A certain level of household wealth has been demonstrated as 48% of the properties have electricity whilst 49% can afford petroleum as a fuel source.

The key potential impact on the social infrastructure is pressure on health services. In addition, there may be more minor impacts on the local education, communication and electricity services. 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 40 and all of these will live in towns where existing facilities can accommodate their

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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 40 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.

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. 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 15m.

7 ENVIRONMENTAL MANAGEMENT PLAN

A framework Environmental Management Plan (EMP) has been prepared as a stand-alone section of the ESIA in accordance with both the requirements of Cameroonian and World Bank/IFC legislation. The structure of the EMP is as follows:

- Environmental Policy – AES Sonel's environmental policy is presented in Appendix M of the ESIA report (Scott Wilson, December 2007);
- Project Overview – this is presented in Section 3;
- Register of Environmental Impacts – this summarises the potential impacts of the project and provides a focus for environmental management;

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- Environmental Standard and Quality Objectives – provides the standards to be applied for the project, which are Cameroonian wherever practical;
- Mitigation and Implementation – summarises the controls to be implemented in the project to remove or minimise potential impacts;
- Monitoring and Evaluation – this sets out the monitoring programme and protocols to be adopted;
- Management Structure – this presents the proposed environmental management requirements;
- Data Handling – this summarises the requirements and responsibilities; and
- Audits and Reviews – as required to ensure successful implementation of the EMP.

Prior to the start of the power plant construction and operation the framework EMP will be developed into a full compliant ISO14001 EMP that encompasses all aspects of mitigation, management, monitoring and institutional measures that will be undertaken by AES Sonel for the Dibamba Power Project.

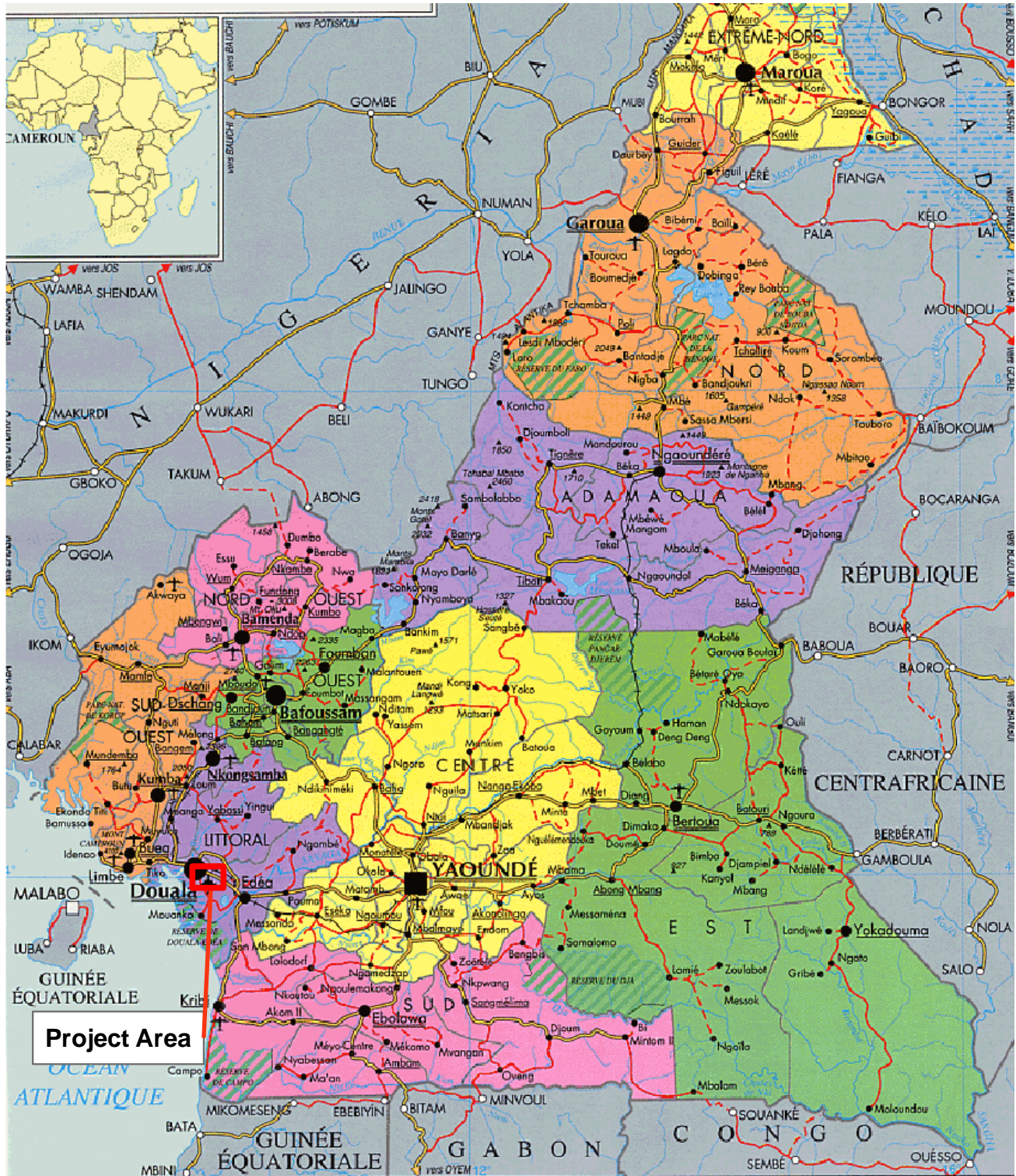
8 SOCIAL MANAGEMENT PLAN

In line with international practice a framework Social Management Plan (SMP) is presented within the ESIA. This framework document includes an outline of the monitoring and management required for the smooth running of the project. The elements of the SMP include:

- Social Policy;
- Project Review;
- Social Standards and Quality Objectives;
- Register of Social Impacts; and
- Mitigation and Implementation.

Prior to the start of any work on site, a detailed SMP will be drawn up.

Figures



Project Area



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KPDC
DIBAMBA POWER PROJECT ESIA
PROJECT LOCATION PLAN



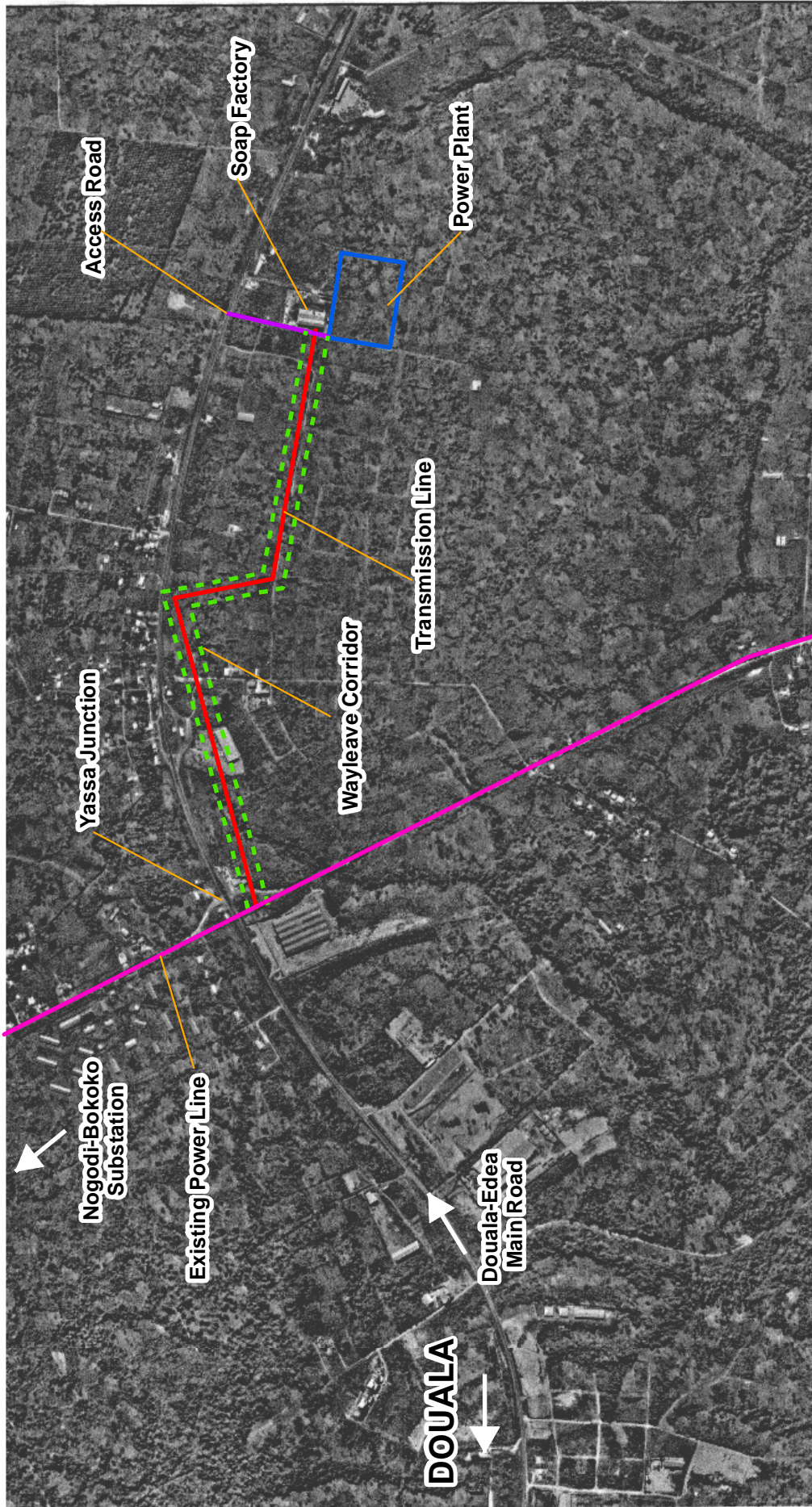
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DIBAMBA POWER PROJECT ESIA

DETAILED LOCATION PLAN



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SITE LOCATION



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Appendix A

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Appendix B

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Environmental and Social Impact Assessment Report

Report Control Form

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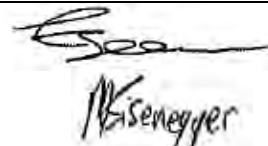
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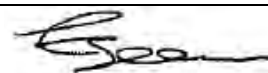
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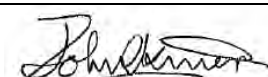
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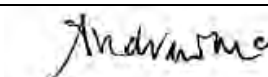
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ABBREVIATIONS

AADT	Average Annual Daily Traffic
ADB	African Development Bank
ADF	Africa Development Fund
AIDS	Acquired immune deficiency syndrome or Acquired immunodeficiency syndrome
ARSEL	Agence de regulation du secteur de l'électricité
CPF	Central Processing Facilities
ECC	Environmental Conformity Certificate
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMF	Electromagnetic Fields
EMP	Environmental Management Plan
EPC	Engineering Procurement and Construction
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental Social Management Plan
EU	European Union
GDP	Gross Domestic Profit
GOC	Government of Cameroon
HAP	Hazardous Air Pollutant
HFO	Heavy Fuel Oil
HGVs	Heavy Goods Vehicles
HIPC	Heavily Indebted Poor Countries
HIV	Human immunodeficiency virus
ICE	Interministerial committee of Environment
ICNIRP	International Commission on Non-Ionising Radiation Protection
IEA	Institute of Environmental Assessment
IFC	International Finance Corporation
IHT	Institute of Highways and Transportation
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature and Natural Resources
KPDC	Kribi Power Distribution Company
LDCs	Least Developed Countries
LFO	Light Fuel Oil
MDG	Millennium Development Goals
MINT	Ministry of Transport
MINTP	Ministry of Public Works

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MoE	Ministry of Environment and Nature Protection
NGOs	Non Governmental Organisations
NIS	National Institute of Statistics
NL	National Land
NRPB	National Radiological Protection Board
OD	Operational Directive
OEMP	Operational Environmental Management Plan
OP	Operational Policy
PAH	Polycyclic Aromatic Hydrocarbons
PAP	Project Affected Per
PCB	Polychlorinated Biphenyls
PPA	Power Purchasing Agreement
PPI	Private Property belonging to Individuals
PPS	Private Property of the State
PS	Performance Standard
PUD	Public Utility Decree
RAP	Resettlement Action Plan
RBS	Rapid Botanical Survey?
SaE	Social and Environmental
SEB	Socio-Economic Baseline
SIA	Social Impact Assessment
SIG	Southern Interconnected Grid
SMP	Social Management Plan
SNH	National Hydrocarbons Company
SOP	Standard Operating Procedures
STI	Sexually Transmitted Infection
SW	Scott Wilson
TA	Tolling Agreement
TMP	Transport Management Plan
TMS	Transport Method Statement
ToR	Terms of Reference
TSP	Transport Sector Project
WHO	World Health Organisation
WMP	Waste Management Plan

Section 1

Introduction

SECTION 1 : INTRODUCTION

1.1 BACKGROUND

Kribi Power Development Company (KPDC), an entity of AES Corporation and the Government of Cameroon, is currently developing the Dibamba Power Project, assisted by AES Sonel, located approximately 20km to the east of Douala in the Littoral Province (see Figure 1.1.1 and 1.1.2) in order to meet the requirements of electricity generation in Cameroon and to ensure the load shedding¹ remains within acceptable, agreed parameters. The project will ensure the expanding electricity requirements of the country (5% growth per annum) as part of the short-term strategic development programme. Further details are provided in Section 3.

The Dibamba Power Project comprises the construction of a 88MW power plant fuelled with Heavy Fuel Oil (HFO) and the erection of a 90kV transmission line between the plant and the existing Ngodi-Bekoko 90kV substation at Ngodi Bekoko 2km to the west of the plant site. In addition, there will be a step-up substation at the new plant site (11kV to 90kV).

The Heavy Fuel Oil will be transported by road in insulated tank trucks from the Limbe Oil Refinery located approximately 120km west of Dibamba.

The Dibamba Power Project will be owned by AES Corporation and the Government of Cameroon through a subsidiary Kribi Power Development Company (KPDC). All the electricity produced will be delivered to the Southern Interconnected Grid (SIG) (see Figure 1.1.3) and sold to AES Sonel through a Tolling Agreement. It is planned that KPDC will own the power plant once it is operational whilst AES Sonel will own the transmission line.

The Dibamba Power Plant is requesting funding through a number of funding institutions, including the International Finance Corporation (IFC), part of the World Bank Group, and the African Development Bank (AfDB). The ESIA is conducted utilising international best practice and guidance produced by these institutions.

1.2 TERMS OF REFERENCE

Scott Wilson Limited has been engaged by AES Sonel to undertake an Environmental and Social Impact Assessment (ESIA) for the Dibamba Power Project.

The ESIA process for the proposed Dibamba Power Project commenced with the preparation of the Terms of Reference (ToR), which set out the scope for the ESIA (AES Sonel, July 2007, see Appendix E). The proposed project was formally registered by the submission of the ToR and payment of the required fees to the Ministry of Environment and Nature Protection. This report documents the process and findings of the ESIA. The ESIA reports have been prepared in accordance with legislation of Cameroon and internationally recognised guidance and standards as adopted by the World Bank and International Financial Corporation (IFC), see Section 2 of the ESIA.

The IFC Performance Standard (PS) 1 – Social and Environmental Assessment and Management Systems clearly illustrates the framework for Environmental Assessment and

¹ Load shedding is the temporary cutting off of electricity current on certain transmission lines when demand is greater than supply.

Section 1: Introduction

identifies the process as one which aims to “identify and assess social and environmental impacts, both adverse and beneficial, in the project’s area of influence, in order to:

- Avoid, or where avoidance is not possible, minimise, mitigate, or compensate for adverse impacts on workers, affected communities, and the environment; and
- Ensure that affected communities are appropriately engaged on issues that could potentially affect them”.

The Dibamba Power Project is classed as a Category B Project under the IFC Project Categories and Category 1 under AfDB guidance.

The Dibamba project has been classified as an IFC Category B project and an AfDB Category 1 project. IFC Category B projects require an ESIA and an Environmental and Social Management Plan (ESMP) to be prepared both of which will have a minimum 30-day disclosure period. AfDB Category 1 projects are those most likely to have the most severe environmental and social impacts and require a full ESIA and ESMP to be prepared (in accordance with AfDB content requirements). For AfDB Category 1 projects consultation should be included throughout the ESIA process.

The above classifications are influenced by the fact that the project is of a small-scale, with the plant site being approximately 7.7 hectares (ha) and transmission line of approximately 1.8km requiring 30m wayleave (5.4ha). The anticipated impact will also entail mitigatable adverse impacts on a non-sensitive, homogenous setting, with some economic (crop) displacement and land acquisition.

The ESIA has been undertaken in accordance with the principles of the World Bank Group, IFC and AfDB guidelines and this ESIA report covers the following aspects:

- An executive summary;
- A description of the project;
- Policy, legal and administrative framework;
- Environmental and Social baseline conditions relevant to the project;
- Prediction of potential environmental and social impacts;
- Identification of appropriate mitigation measures;
- Assessment of the significance of the potential impacts;
- Analysis of alternatives; and
- Development of appropriate frameworks for environmental monitoring, an Environmental Management Plan and Social Management Plan.

The scoping and ESIA reports have been prepared in English. The Executive Summary will be translated into French, if required.

1.3 LOCAL PARTNERS

1.3.1 Safex

In order to ensure the effectiveness of the assessment, the Scott Wilson team employed a local consultancy 'Safex', to assist with various pieces of work. In many instances the Scott Wilson team has trained the Safex team in the required tasks. The areas which they assisted have been highlighted throughout the ESIA.

1.4 METHODOLOGY AND REPORTING

1.4.1 Methodology

The overall methodology adopted for undertaking the Dibamba Power Project ESIA has been based on the requirements of Cameroonian Legislation as set out in the EIA Decree N° 2005/0577 of 23rd February 2005 and summarised in Table 1.3.1 together with international best practice, including World Bank Operational Policies (OP) 4.01, IFC Performance Standard 1 and IFC Environmental, Health and Safety Guidelines. Preparation of this report has included the following stages, which are not independent but in many instances have been undertaken in conjunction:

- (i) **Scoping exercise** - The scoping exercise was undertaken initially by AES Sonel through the ToR in July 2007 and followed by a scoping field visit by Scott Wilson in August and September 2007. This involved field visits (see below) and the gathering and review of published and unpublished baseline/project data. The scope identified the key environmental and social impacts (see Section 4.3) and directed the detailed assessment for the project. This ESIA therefore considers the potential environmental and social impacts of the proposed project activities identified during the scoping stage of the project, through construction, operation and decommissioning. Consideration has also been given to project alternatives, including the "without project" option (i.e. no project option).
- (ii) **Field Visits were carried out by the ESIA team** to view the project proposals in the field and to facilitate input to design development in line with best practice. A preliminary visit was undertaken between 11th to 21st September 2007 by a Scott Wilson team and additional site visits were undertaken from 19th to 30th November 2007 to undertake fauna and flora studies; noise monitoring; route and traffic surveys; water resource studies; socio-economic baseline studies and public consultation; and socio-economic survey work was also undertaken for the site and along the route of the proposed power line.

The project, which was subject to the ESIA, together with other alternatives considered, is set out in Section 3 of this report.

- (iii) **Identification of appropriate Cameroon legislation and guidelines** is set out in Section 2.
- (iv) **Consultations** have been held with the government Ministries, authorities and affected communities. Development of the methodology was subsequently undertaken and the results are presented in Section 4. The issues raised have been taken into account in the preparation of this report.

Section 1: Introduction

- (v) **Baseline Data** gathering and review of published and unpublished data pertinent to the project site. Baseline data and all key documents utilised in the preparation of the ESIA report are listed in the References section at the end of this report. The results of baseline studies commissioned for the project, together with information gathered in the data review, are presented within each of the environmental and social disciplines examined in Sections 5 and 6 of this report.
- (vi) **Potential Impacts** were identified from critical analysis of the proposed construction and operation of the power plant in relation to the environment setting. The identification of impacts drew on data from the available documentation, baseline studies and on the experience of the Scott Wilson study team. The results are presented in Sections 5 and 6.
- (vii) **Mitigation measures** include proposed programs or processes implemented to eliminate or minimise the potential impacts identified for each system studied. Mitigation options include preventive engineering implemented during the design phase of the project, ongoing and planned programs to eliminate or minimise impacts during the construction of the project, and monitoring plans to evaluate the success of the mitigation. An evaluation of the level of predicted impacts that will remain after the implementation of all proposed mitigation measures has also been undertaken. The nature of the predicted impact is described and its significance determined by reference to appropriate standards or guidelines.
- (viii) **Environmental and Social Management** encompasses all aspects of mitigation, management, monitoring, and institutional measures. The provisional Environmental and Social Management Plans for the project are presented in Sections 7 and 8.

Section 1: Introduction

Table 1.3.1: Cameroon EIA Procedures^{1,2}		
Article	Issue	Requirements
1 - 3	EIA	<ul style="list-style-type: none"> The general provisions and requirements for the EIA if a development is determined to have a potentially significant impact on the environment.
4 & 5	EIA Contents	<ul style="list-style-type: none"> Requirements for the contents of a brief and detailed EIA report, respectively.
6	Activities	<ul style="list-style-type: none"> The activities that will be subject to an EIA.
7	Initiation of the EIA Procedure	<ul style="list-style-type: none"> Preparation of a report containing the project description, justification for the project and the Terms of Reference (ToR) for the EIA by the proponent. Submission of report and supporting fee to Ministry responsible for Environment (the Ministry of Environment and Nature Protection (MoE)). Within 10 days, MoE submits its opinion to the Minister in charge of the Environment (The Minister). Within 20 days of report receipt, the MoE confirms EIA requirements to the proponent. If the proponent receives no feedback within 30 days of submission, the ToR is deemed satisfactory.
8	Preparation of EIA Report	<ul style="list-style-type: none"> The EIA is prepared by the proponent in line with the ToR agreed with the MoE. The proponent can utilise consultants for the EIA reporting, with preference being given to Nationals.
9 & 10	Acceptability of EIA Report	<ul style="list-style-type: none"> The proponent submits 20 copies of EIA report to the MoE together with the fee. The competent Administration and the MoE form a team to undertake a site visit to verify the EIA report findings in the field and collect opinions of the local communities on the project. The team will then prepare an evaluation report within 20 days of receipt of the EIA report on its opinion to the administration. A decision on the acceptability of the EIA report is provided 20 days by the MoE. If acceptable the MoE will publish information within the media or, if not acceptable, the proponent will advise accordingly. If a decision is not received after 20 days the EIA report is deemed acceptable.
11 - 14	Consultations and Public Hearings	<ul style="list-style-type: none"> The determination of the acceptability of the EIA then involves consultation and public hearings, which will also include meetings with communities undertaken during the study. The proponent must provide 30 days notification prior to the first consultation meeting. Public consultation and public hearings are then undertaken. Minutes of the meetings must be sanctioned by the proponent and the population representatives. These Minutes must also be included in the EIA report. An ad hoc Commission presents a report of the findings to the MoE and the ICE within 30 days.
15 - 17	Study Approval	<ul style="list-style-type: none"> The administration in charge of the environment submits to the ICE, the EIA report, opinions on the EIA and the registers of the consultation. The ICE has 20 days to give an opinion, if there is a delay the EIA is considered approved. The Minister of Environment then has a further 20 days to make its decision on the EIA. On approval an Environmental Conformity Certificate (ECC) is issued, this is required before construction of the project can commence. If the project is not commenced within 3 years of issue of the ECC, the certificate is deemed obsolete.
18 – 20	Monitoring and Environmental Follow Up	<ul style="list-style-type: none"> Requires the effective implementation of the EMP (included separately in the EIA). Additional measures can be required if not considered in the EIA report.
21 - 23	Subsequent Reporting	<ul style="list-style-type: none"> Within 36 months of ECC an environmental audit is required to assess the EMP implementation, which must be submitted to the MoE for approval.

¹ EIA Decree of Cameroon, 2005 / 0577, 23rd February 2005 ² For the Dibamba Power Project an ESIA has been undertaken, which will follow the same procedures as an EIA

Section 1: Introduction

1.4.2 Reporting

This ESIA report provides an assessment of the proposed Dibamba Power Project for construction and operation. The report is presented with the baseline, potential impacts, mitigation measures and evaluation of mitigated impacts within a single section for each environmental and social issue within the Chapters for EIA and Social Impact Assessment (SIA) (see Sections 5 and 6) respectively. The report structure, which takes into the requirements of Article 5 of Decree 2005/0577, is:

Executive Summary - concisely discusses significant findings and recommended actions.

Section 1 - Introduction - background to the study, the terms of reference, terminology, outline of the methodology to the ESIA and the report structure.

Section 2 - Legislative Background - relevant international and national legislation.

Section 3 - The Project - a description of the proposals with emphasis on identification of those elements that have particular relevance to the environment, as well as an overview of alternatives including the “zero or without project” option.

Section 4 - Scoping & Consultation - outline of the terms of reference for the ESIA as defined and consultation undertaken, together with comments and outcomes.

Section 5 - Environmental Impact Assessment - description of baseline environmental conditions, identification of the important environmental issues and assessment of potential impacts on the environment, mitigation measures and residual impacts (impacts remaining after mitigation) for specialist environmental topics.

Section 6 - Social Impact Assessment - description and analysis of general social and economic conditions, analysis of potential impacts on the affected communities, identification of mitigation measures and evaluation of these mitigation measures.

Section 7 - Environmental Management Plan - a framework for the mitigation measures and environmental controls that AES Sonel will use to manage the potential impacts from the project.

Section 8 - Social Management Plan - a framework for managing key social aspects of the project including relationships with the local community, community development strategies and how to deal with potential conflicts.

Figures - plans showing overview and details of project components.

Photos - providing a pictorial appreciation of the project components and existing setting.

Appendices - which include a list of persons involved in the preparation of the ESIA; references (a listing of documents used within the preparation of the ESIA) (see Appendix A and B respectively); and appendices from Section 5 and 6.

1.5 PUBLIC CONSULTATION AND DISCLOSURE

Public consultation in environmental decision-making is an important element of the ESIA process. The consultation process for the Dibamba Power Project follows World Bank and International Finance Corporation (IFC) guidelines, as specified in the terms of reference. A good consultation strategy that is both consistent and transparent ensures that concerns or problems for all stakeholders can be identified and addressed early in the project development process.

The IFC's PS1 requires the client to "undertake a process of consultation in a manner that provides the affected communities with opportunities to express their views on project risks, impacts, and mitigation measures, and allows the client to consider, and respond to them².

In addition, *OP4.01 Environmental Assessment* emphasises this concept and notes that the project sponsor (KPDC) should consult project-affected groups and local non-governmental organisations (NGOs) about the project's environmental aspects and take their views into account. Consultations should be initiated as early as possible, during the preparation of the EIA. In addition, the project sponsor consults throughout project implementation, as necessary to address ESIA related issues. Once the draft ESIA report is prepared, AES Sonel will need to provide the draft report prior to consultation and in a form and language that are understandable and accessible to the groups being consulted, including local NGOs.

An additional fundamental requirement in World Bank/IFC policies on resettlement (land acquisition and compensation) is a framework for public consultation, participation, and the establishment of a process to redress the grievances of affected people. Consultation with the affected population and with officials of local government, civil society and other representatives of the affected population is essential for gaining a comprehensive understanding of the types and degree of adverse effects. This has been undertaken for Dibamba Power Project by working through the local political structures and protocols.

The IFC's *Doing Better Business Through Effective Public Consultation and Disclosure: A Good Practice Manual* (IFC, 1998) provides action oriented guidelines aimed at ensuring that consultation with the affected population and with officials of local government, civil society organisations and other representatives of the affected population is both effective and meaningful. The guidelines emphasise the need for the project sponsor to ensure that the process of public consultation is accessible to all potentially affected parties, from national to local level. Emphasis is placed on the engagement of local stakeholders, namely people who are likely to experience the day-to-day impacts of a proposed project. On a practical level, the sponsor has to ensure that:

- All stakeholders have access to project information;
- The information provided can be understood;
- The locations for consultation are accessible to all who want to attend; and
- Measures are put in place which ensure that vulnerable or minority groups are consulted.

² International Finance Corporation (2006) Performance Standard 1: Social and Environmental Assessment and Management Systems.

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The consultation requirements for projects requiring physical or economic displacement are covered by *OP 4.12, Involuntary Resettlement* and outlined in the IFC's '*Handbook for Preparing a Resettlement Action Plan*' (IFC, 2002).

This ESIA Report will be submitted to the Ministry of Environment and Nature Protection for their review. KPDC will, as necessary, provide additional copies and assistance with distribution. As previously mentioned the main ESIA report will be in English, whilst the executive summary will be in English and translated into French, if required.

Details of the consultation undertaken for the project are presented in Section 4 of this ESIA report.

1.6 TERMINOLOGY

With regard to terminology used in the ESIA, specific technical terms are explained in the appropriate section of the text. However, in the interests of clarity and consistency, a number of terms defined in the text are defined in Table 1.5.1. A listing of abbreviations used in the ESIA is presented at the front of this report.

Table 1.5.1: Dibamba Power Project - ESIA Terminology	
Term	Definition
<i>Nature of predicted impacts</i>	
Neutral	No overall environmental impact.
Adverse	Negative environmental impact.
Beneficial	Positive environmental impact.
<i>Significance of predicted impacts⁽¹⁾</i>	
Insignificant	An impact which is either too small to be measured or, even if quantifiable, does not give rise to any material change in the environment.
Minor	An impact that is capable of causing change in the environment but does not fundamentally affect the status, potential productivity or usage of the environment.
Significant	An impact that is capable of causing sufficient change in the environment to affect the status, potential productivity or usage of the environment.
<i>Duration of predicted impacts¹</i>	
Short term	An impact that persists for 15 months or less (i.e. during construction period)
Medium term	An impact that persists for between 15 month and five years (i.e. during initial operations)
Long term	An impact that persists for longer than five years .

¹ The classification of an impact as temporary, short-term or long-term is purely descriptive and does not, of itself, imply a degree of significance or acceptability (thus, a temporary impact may also be a significant impact, whilst a long-term impact may be in- / non-significant).

Section 2

Legislative Background

SECTION 2 : LEGISLATIVE BACKGROUND

2.1 INTRODUCTION

For this ESIA, particular reference is made to Cameroon environmental and social legislation and standards. In addition, where appropriate, due reference is made to international standards in order to establish the regulatory framework within which this ESIA for the project has been undertaken. The relevant international environmental and social agreements to which the country is a party are also identified.

In line with World Bank Group IFC Performance Standards and associated requirements, this section of the Dibamba Power Project presents a policy, legal and administrative framework.

2.2 CAMEROON LEGISLATIVE FRAMEWORK

2.2.1 Introduction to Cameroon's Legislative Framework

The legal framework in Cameroon is made up of legislative and regulatory instruments:

- *Legislative instruments* are made up of Laws; and
- *Regulatory Instruments* are composed of Decrees and Rules.

Laws are prepared by Sectorial Ministries and forwarded to the national assembly. During working sessions, these are adopted by members of parliament and later on enacted by the head of state.

A law is generally a framework of intervention within a specific sector. To be implemented, it needs regulatory instruments, which are called decrees of application. Ministries who have prepared the concerned law prepare decrees, which are then signed by the Prime Minister Head of Government.

To be more detailed, a Decree sometimes needs implementation Rules. The Rule is prepared by the Ministry and signed by the Minister, after a visa from the Services of Prime Minister.

The application of all legislative and regulatory instruments is compulsory for all citizens and project promoters. These instruments are therefore provided with sanctions for defaulters, which vary from prison sentence to fine payment, dependent on the gravity of the fault.

2.2.2 Cameroon Legislation, Standards and Guidelines

The main laws and regulations of relevance to the ESIA for the Dibamba Power Project are summarised in Table 2.2.1 below. Discussion on Cameroon's EIA procedure and reporting is presented in Section 1.3 of this report.

There are currently no specific national standards for water quality, air quality and noise limits. Acceptable levels for environmental noise are in preparation. In the absence of national standards, recognised international standards have been adopted as detailed in the relevant sections of this document (Sections 5 to 8).

Section 2: Legislative Background

Table 2.2.1: Relevant Cameroonian Legislation	
Subject	Law/Decree/Order
Environmental Management	<p>Law N° 96/12 of 5th August 1996 Relating to Environmental Management in Cameroon</p> <ul style="list-style-type: none"> • Decree N° 2001/718/PM of 3rd September 2001 The organization and functioning of the Interministerial committee on the Environment • Decree 94/259/PM of 31st May 1994. Creation of a National consultative Commission on the Environmental and sustainable Development. • Decree N° 2005/0577/PM of 23rd February 2005 Defining the conditions for undertaking EIA • Ministerial Order N° 0069/MINEP of 08th March 2005 - Defining the categories of operations subject to EIA • Rule n° 0070/MINEP of 22nd April 2005 fixing the different categories of operations submitted to the realization of an EIA (article 19 of the law)
Cultural Heritage	<p>Law N° 91/008 of 30th July 1991 - The protection of cultural and national heritage. This law identifies the procedures for protection of sites and materials of cultural and national heritage. It applies to cultural sites that may be found along the projected line corridor.</p>
Dangerous Substances	<p>Law n° 98/015 of 14th July 1998 - Relating to installations classified as dangerous, insalubrious, and inconvenient</p> <ul style="list-style-type: none"> • Decree N° 98/818/PM of November 1999 - Laying down conditions for construction and operation of installations classified as dangerous, insalubrious, and inconvenient
Water	<p>Law No. 98/005 dated 14th April 1998 – relating to water (the “Water Act”);</p> <ul style="list-style-type: none"> • Decree No. 2001/164/PM dated 08th May 2001 – “Decree on Utilisation of Water”, which sets the conditions of utilisation of water for business or industrial purposes • Decree No. 2001/165/PM of 08th May 2001 decree on the “Protection of Water”, which sets the conditions of the protection of surface and groundwater against pollution
Wildlife and Forestry	<p>Law N° 94/01 of 20th January 1994 to lay down Forestry, Wildlife and Fisheries Regulations This law and the implementing instruments thereof lay down forestry, wildlife and fisheries policy, within the framework of an integrated management ensuring sustainable conservation and use of the said resources and of various ecosystems.</p> <ul style="list-style-type: none"> • Under this law, forests means any land covered by vegetation, with a predominance of trees, shrubs and other species capable of providing products other than agricultural produce. • Wildlife within the context of this law means all the species belonging to any natural ecosystem as well as all animal species captured from their natural habitat for domestication purposes. • Fisheries or fishing, within the context of this law, means the act of capturing or of harvesting any fishery resources or any activity that may lead to the harvesting or capturing of fishery resources, including the proper management and use of the aquatic environment, with a view to protecting the animal species therein by the total or partial control of their life cycle. • Fishery resources within the context of this law, means fish, seafood, molluscs and algae from the marine, estuarine and fresh water environments, including sedentary animals in such environments. • Decree n° 95-531-PM of 23rd August 1995 to determine the conditions for implementation of Forestry Regulations • The Decree n° 95-466-PM of 20th July 1995 to lay down the conditions for the implementation of Wildlife Regulations • Decree n° 95-678-PM of 18th December 1995 to establish an indicative framework for land use in the southern forested areas.

Section 2: Legislative Background

Table 2.2.1: Relevant Cameroonian Legislation	
Subject	Law/Decree/Order
Electricity	<p>Law N° 98/022 of 24th December 1998. The Regulation of the Electricity Industry. The law enables the government to operate the electricity generation and supply industry through a concession and establishes the Agence de Regulation du Secteur Electricité – ARSEL (the Electricity Regulation Agency) to regulate the industry. ARSEL is required to ensure that electricity operations respect environmental legislation.</p> <ul style="list-style-type: none"> • Decree N° 99/125 of 15th Jan 1999; The Organization and functioning of the Agency for the Regulation of the Electricity Industry; • Decree 2000/464 of 20th June 2000 Register of Activities of the Electricity Industry.
Land	<p>Ordinance No. 74-2 dated 6th July 1974 – relating to the status of the public domain in Cameroon (the “Land Code”).</p> <ul style="list-style-type: none"> • Decree No. 76-166 dated 27th April 1976-relating to the management of the national domain (the “National Domain Decree”); • Decree No. 76-167 dated 27th April 1976 – relating to the management of the private domain (the “Private Domain Decree”).
Compulsory Acquisition	<p>Law n° 85/009 of 4th July 1985 - Compulsory Acquisition of a Public Utility Decree (PUD) and payment of compensation the Environment.</p> <ul style="list-style-type: none"> • Ministerial Order N° 0136/Y.14.4/MINDAF/D220 and 0137/Y.14.4/MINDAF/D220 of 26th August 2005 - Declaring Public Utility for the Construction of the Dibamba thermal power plant and the 90KV Transmission line from Dibamba to Edéa respectively.
Valuation	<ul style="list-style-type: none"> • Rule n° 00832/4-15-1/MINUH/D.000 of 1985 providing the basis for calculation of constructions values • Rule n° 13-MINAGRI/DAG of 19th February 1982 modifying the Rule n° 58/MINAGRI of 13th August 1981 fixing the indemnity tariffs to owners of crops and houses destroyed during a project implementation

2.2.3 Cameroon Institutional Framework

The relevant institutions involved in the implementation and monitoring of environment law in Cameroon are:

- *ARSEL (Agence de régulation du secteur de l’électricité)* – authority responsible for regulation of the energy sector;
- *The Inter-Ministerial Committee of Environment (ICE)* which is under the responsibility of the Ministry of Environment and Nature Protection;
- *Consultative national commission of environment and sustainable development;*
- *The Minister in charge of Energy and Water Resources;* and
- *The Minister in charge of Environment:* Ministry of Environment and Nature Protection (MoE).

In addition, other ministries of relevance include: the Ministry of Agriculture and Rural Development, Ministry of Transport (MINT), which is responsible for the transportation of people and goods by sea, air and land; the Ministry of Culture; the Ministry of Housing and

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Urban Development; the Ministry of Public Works; the Ministry of Territorial Planning and Development; and the Ministry of Forestry and Wildlife.

2.3 INTERNATIONAL LEGISLATION AND GUIDANCE

Where appropriate for the ESIA study, due reference is made to international standards in order to establish a regulatory framework for the project which is in line with local and international requirements.

In addition to satisfying the requirements of Cameroonian permitting process, it is acknowledged that AES Sonel envisages financial support from the World Bank Group and the African Development Bank (AfDB). Consequently this report has been prepared with reference to the AfDB, World Bank and International Finance Corporation (IFC)¹ guidance.

The undertaking of a comprehensive ESIA is seen by international funding agencies as fundamental to the promotion of a sustainable and economically viable power operation. The ESIA is considered as an integral part of the project development and a precursor to the formulation of a practical and effective environmental management strategy rather than as an end in itself. This approach is intended to ensure that the inter-relationship between the proposed development and the potential environmental consequences of that development are managed in a way which promotes the maximum benefit to the developer, whilst ensuring the highest degree of protection of the environment and benefits to the local community.

The IFC is the private sector arm of the World Bank Group and the largest multilateral source of loan and equity financing for private sector projects in developing countries. The IFC adopted in April 2006 an improved set of 8 business standards for managing environmental and social risks and impacts associated with its investments, which apply to every new IFC-financed project². Guidance to the implementation of the requirements set out in the Performance Standards is provided in a set of 8 Guidance Notes. The Performance Standards are summarised in Table 2.3.1 together with their relevance to the Dibamba Project. The classification of the project according to the IFC categorisation criteria is detailed in section 2.3.1 below together with a summary of the category-specific IFC procedural requirements.

The AfDB is a multilateral development bank and the premier financial development institution of Africa. The AfDB aims to promote economic and social development through loans, equity investments, and technical assistance, and has a series of procedural requirements and guidelines aimed at ensuring that the projects in which it invests are implemented with due regard to environmental and social considerations. The classification of the project according to the AfDB categorisation criteria is detailed in section 2.3.2 below together with a summary of the category-specific AfDB procedural requirements.

In addition, the following documents and policies which have been referred to in the preparation of this ESIA include:

- IFC's 1998 Procedure for Environmental and Social Review Projects;

¹ The IFC provides private sector financing in developing countries. The IFC is a member of the World Bank group.

² International Finance Corporation (2006) Training on IFC Performance Standards.

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- IFC’s Policy on Social and Environmental Sustainability (30th April 2006);
- IFC’s Performance Standards on Social and Environmental Sustainability (30th April 2006);
- IFC’s Policy on Disclosure of Information (30th April 2006);
- World Bank Pollution Prevention and Abatement Handbook (1998);
- World Bank OP 4.01 Environmental Assessment (1999);
- African Development Bank (AfDB) Integrated Environmental and Social Assessment Guidelines;
- AfDB Group’s Policy on the Environment;
- AfDB Environmental and Social Assessment Procedures for AfDB’s Public Sector Operations; and
- AfDB Industrial Sector Policy Guidelines.

Title	Summary of requirements	Relevance to Project
PS1: Social and Environmental Assessment and Management Systems	The PS includes requirements for projects with social or environmental risks and impacts to undertake Social and Environmental (SaE) Assessment, SaE Management System, Management Program, Organisational Capacity, Training, and Community Engagement.	Applicable as the project is a Category A project and therefore subject to ESIA.
PS2: Labour and Working Conditions	Sets out requirements to ensure that the pursuit of economic growth through employment creation and income generation is balanced with protection for basic rights of workers (including working conditions, child and forced labour, occupational health and safety, non-employee workers and the supply chain).	<i>“Applicability to be established during the ESIA, while implementation of necessary actions to meet the requirements of this PS is managed through the clients’s SaE Management System.”</i>
PS3: Pollution Prevention and Abatement	Sets out requirements aimed at minimising pollution from project activities and promote reduction of emissions that contribute to climate change. These include <i>inter alia</i> specific requirements re. the reduction of wastes, greenhouse gas emissions, etc.	Applicable
PS4: Community Health, Safety and Security	Sets out requirements aimed at minimising risks and impacts to the health and safety of the local community during the project life cycle. This includes issues such as infrastructure and equipment safety, hazardous materials, emergency preparedness and response.	Applicable.
PS5: Land Acquisition and Involuntary Resettlement	Sets out requirements to avoid/minimise and/or mitigate adverse social and economic impacts from land acquisition or restrictions on affected persons’ use of land, and improve or at least restore the standards of living of displaced persons (this includes <i>inter alia</i> private sector responsibilities under government-managed resettlement)	Applicable, as the project will require loss of productive assets both at the plant site and along the transmission line corridor.

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Title	Summary of requirements	Relevance to Project
PS6: Biodiversity Conservation and Sustainable Natural Resource Management	Sets out requirements for the protection and conservation of biodiversity and the sustainable management and use of renewable natural resources.	Not Applicable, as the project site and transmission line corridor are situated within areas of highly disturbed agricultural, fallow and scrub habitats. Specific baseline surveys and consultation have been conducted to confirm applicability.
PS7: Indigenous Peoples	Sets out requirements to ensure that the development project establishes and maintains an ongoing relationship with Indigenous Peoples affected and avoids, or minimizes and mitigates/compensates for any adverse impacts, fosters negotiation and informed participation and respects and preserves Indigenous cultures.	Applicable.
PS8: Cultural Heritage	Aims to protect cultural heritage from the adverse impacts of project activities and support its preservation, and promote the equitable sharing of benefits from the use of cultural heritage in business activities. Project requirements include <i>inter alia</i> the use of internationally recognised practices, and consultation with local communities.	Applicable. Specific baseline surveys and consultation have been conducted to confirm applicability.

2.3.1 IFC Project Category and Requirements

IFC Category

All IFC financed projects must comply with the requirements of the IFC Performance Standards as detailed in Table 2.3.1. The present project has been identified as an IFC Category B Project and as such an ESIA and ESMP (Environmental and Social Management Plan) must be completed to meet the IFC requirements. IFC Category B Projects require a minimum 30-day disclosure period⁴.

IFC Environmental, Health and Safety Guidelines

The EHS Guidelines are technical reference documents with general and industry-specific examples of “Good International Industry Practice”. Reference to the EHS Guidelines by IFC clients is required under IFC Performance Standard 3.

The EHS Guidelines contain the performance levels and measures that are normally acceptable to IFC and are generally considered to be achievable in new facilities at reasonable costs by existing technology. For IFC financed projects, application of site-specific targets with an appropriate timetable for achieving them. The environmental assessment process may recommend alternative (higher or lower) levels or measures, which, if acceptable to IFC, become project- or site-specific requirements⁵.

⁴ International Finance Corporation. Definitions of Project Categories. Available on [http://www.ifc.org/ifcext/disclosure.nsf/Content/Project_Categories]. Accessed 06.12.2007.

⁵ International Finance Corporation. Environmental, Health and Safety Guidelines. Available on [http://www.ifc.org/ifcext/enviro.nsf/Content/EnvironmentalGuidelines]

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2.3.2 AfDB Project Category and Requirements

The present project has been classified as an AfDB Category 1 project, for the same reason it is IFC Category A, i.e. a project which is “likely to induce important adverse environmental and/or social impacts that are irreversible or to significantly affect environmental or social components considered sensitive⁶ [by the Bank or borrowing country]. It requires a full Environmental and Social Impact Assessment (ESIA) and an Environmental and Social Management Plan (ESMP) to be undertaken (with contents and scope in accordance with the requirements of the Environmental and Social Assessment Procedures for African Development Bank’s Public Sector Operations (the AfDB Procedures)).

The AfDB Procedures state that Category 1 projects should:

- Undertake Environmental and Social Scoping and produce a Social Scoping Memorandum;
- Prepare an ESIA Terms of Reference (ToR) involving consultations with relevant stakeholders as per AfDB guidance;
- Undertake an ESIA in accordance with best practice guidance as detailed by the AfDB; and
- Ensure that consultation of relevant primary and secondary stakeholders is undertaken during the preparation of the ESIA.

2.3.3 International Protocols, Agreements and Treaties

In line with international guidance, Tables 2.3.2 identify the international environmental and social Protocols, Agreements and Treaties to which Cameroon is a party respectively. In addition, Cameroon is a party to the following regional agreements:

- African Convention on the conservation of Nature and Natural Resources (Maputo Convention of 11th July 2003);
- Bamako Convention on the ban of the import into Africa and the control of transboundary movement and management of hazardous wastes within Africa (or Agreement of implementation of Basel convention in Africa); and
- Treaty relative to the conservation of biodiversity and sustainable management of forest ecosystems in Central Africa (April 2006).

⁶ African Development Bank (2001) Environmental and Social Assessment Procedures for African Development Bank’s Public Sector Operations.

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Table 2.3.2: International Environmental Agreements relevant to Cameroon		
Issue	Convention and Objective	Cameroon Status
Biodiversity	<i>Convention on Biological Diversity</i> Objective: To develop national strategies for the conservation and sustainable use of biological diversity (Opened for signature: 5th June 1992, in force as of: 29th December 1993)	Ratified 19th October 1994
Climate Change	<i>United Nations Framework Convention on Climate Change</i> Objective: To achieve stabilization of greenhouse gas concentrations in the atmosphere at a low enough level to prevent dangerous anthropogenic interference with climate system (Opened for signature: 9th May 1992, in force : 21st March 1994)	Ratified 19th October 1994
Desertification	<i>United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa</i> Objective: to combat desertification and mitigate the effects of drought through national action programs that incorporate long-term strategies supported by international cooperation and partnership arrangements (Opened for signature: 14th October 1994, in force as of: 26th December 1996)	Ratified, 1994
Endangered Species	<i>Convention on the International Trade in Endangered Species of Wild Flora and Fauna (CITES)</i> Objective: to protect certain endangered species from overexploitation by means of an import/export permits (Opened for signature: 3rd March 1973, in force: 1st July 1975)	Party to
	<i>Convention on the Conservation of Migratory Species of Wild Animals</i>	Party to
Hazardous Wastes	<i>Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal</i> Objective: to reduce transboundary movements of wastes subject to the Convention to a minimum consistent with the environmentally sound and efficient management of such wastes; to minimize the amount and toxicity of wastes generated and ensure their environmentally sound management as closely as possible to the source of generation; and to assist Least Developed Countries (LDCs) in environmentally sound management of the hazardous and other wastes they generate (Opened for signature: 22nd March 1989, in force as of: 5th May 1992)	Party to
Law of the sea	<i>United Nations Convention on the Law of the Sea</i> Objective: to set up a comprehensive new legal regime for the sea and oceans; to include rules concerning environmental standards as well as enforcement provisions dealing with pollution of the marine environment (Opened for signature: 10th December 1982, in force as of: 16th November 1994)	Party to
Natural and Cultural Heritage	Convention on Protection of Natural and Cultural Heritage	Ratified 1982
Nature and Natural Resources	<i>African Convention on the Conservation of Nature and Natural Resources</i> Objective is to ensure the conservation, utilisation and development of soil, water, flora and faunal resources in accordance with scientific principles and with due regard to the best interests of the people (Algiers, 1968)	Ratified 29th September 1978

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Table 2.3.2: International Environmental Agreements relevant to Cameroon		
Issue	Convention and Objective	Cameroon Status
Ozone layer protection	<i>Montreal Protocol on Substances That Deplete the Ozone Layer</i> Objective: To protect the ozone layer by controlling emissions of substances that deplete it (Opened for signature: 16th September 1987, in force as of: 1st January 1989)	Ratified 30th August 1989
Timber	<i>International Tropical Timber Agreement, 1994</i> to ensure that by the year 2000 exports of tropical timber originate from sustainably managed sources; to establish a fund to assist tropical timber producers in obtaining the resources necessary to reach this objective (<i>opened for signature – 26th January 1994, entered into force – 1st January 1997</i>)	Party to
Wetlands	<i>Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar)</i> Objective: to stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value (Opened for signature: 2nd February 1971, in force as of: 21st December 1975)	Ratified 2006
Women's Rights	<i>United Nations Convention on the elimination of all Forms of Discrimination against Women 1979</i> 'For the purposes of the present Convention, the term "discrimination against women" shall mean any distinction, exclusion or restriction made on the basis of sex which has the effect or purpose of impairing or nullifying the recognition, enjoyment or exercise by women, irrespective of their marital status, on a basis of equality of men and women, of human rights and fundamental freedoms in the political, economic, social, cultural, civil or any other field.'	Ratified, 23rd August 1994
Rights of Children	<i>United Nations Convention on the Rights of the Child 1989.</i> This outlines children's civil, political and basic human rights and includes their right to education and to end child labour and other forms of economic and or sexual exploitation.	Ratified, January 1993
Torture	<i>The Convention Against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment (1984)</i> Objective to achieve the abolition of torture and ill treatment worldwide.	Acceded, 19th December 1986

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3.1 NEED FOR THE PROJECT

3.1.1 Overview of Electricity Sector in Cameroon

The late 1990s marked the beginning of reforms in the Cameroonian electricity sector; the Law n° 98/022 of 24th December 1998 organised the electricity sector in Cameroon by redefining the role of the administration to be in charge. According to the AES Sonel annual report of 2000-2001, the Sonel privatisation process started in 1997 and ended in 18th July 2001. The decision to privatise was taken in October 1999. Alongside the implementation of the aforementioned law, some other measures were taken:

- *The creation of ARSEL (Electricity Regulatory Boards) in charge of regulating, controlling, and follow-up electricity sector operators;*
- *The creation of AER (Rural Electrification Agency) in charge of rural electrification promotion and to provide technical assistance to customers and sector operators;*
- *The Law n° 99/06 of 22nd December 1999, on general status of public establishments and state owned enterprises;*
- *The Decree n° 2000/464/PM of 30th June 2000, organising the electricity sector activities; and*
- *The partial privatisation of Sonel: as from July 2001, the current ownership structure is the result of a partial privatisation which is 56% owned by AES Corporation and 44% by the Government of Cameroon.*

In Cameroon, electricity generation is predominately produced from hydro-electric plants. Cameroon has the second highest hydroelectric potential in the African continent (55.2 GW). Before AES Sonel's development in Cameroon, diesel plants totalled 121MW whilst AES Sonel has built several others plants totalling 132MW (of which, small high speed diesel plants totalling 47MW and an 85MW HFO are in Limbe). In addition, there are some autonomous private companies that have also installed capacity of about 74MW to generate electricity for their personal consumption (Projet de politique et de plan énergétiques pour le Cameroun, Ministère des mines, de l'eau et de l'énergie published by the National Institute of Statistics, Direction de l'énergie/ SNC Lavalin International Inc, Montréal, Canada, December 1990). AES Sonel currently has an installed capacity of 933MW consisting of:

- 721MW hydroelectrical;
- 188MW grid-connect thermal capacity; and
- 24MW isolated thermal capacity.

The hydro plants are located at Song Loulou and Edéa on the Sanaga river and at Lagdo for the Northern Interconnected Grid. At present, there are three reservoir dams at Mbakaou, Bamendjin and Mape to regulate the flow in the Sanaga River and increase the electrical output from the aforementioned hydro plants. These reservoirs have a combined capacity of 7.7 billion cubic metres.

It is understood that there has not been a significant alteration in the transmission line network (225kV, 110kV and 90kV) since the establishment of AES Sonel (only 11.6km of 90kV line for the Limbe project was constructed in 2004). For transmission, there are in

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total 480km lines of 225kV, 337km of 110kV and 1064km of 90kV in the Southern Interconnected Grid. The medium voltage lines (5.5kV to 33 kV) increased from 10,316km to 11,450km, and the low voltage lines increased from 10,017km to 11,158km following the reform of the electricity sector.

AES Sonel has three different categories of customers: high, medium and low voltage. The high voltage usually consumes about 45% of the total production due to their dependency on electricity. The public sector demand which makes up the remaining 55% consists of 28% low voltage domestic usage, 4% low voltage non-domestic usage and 23% medium voltage usage. From the 1998 dry season, power rationing was introduced for industrial customers. Grid expansion is required to provide electricity to all communities. Figures on access to electricity between 1996 and 2001 are summarised in Table 3.1.1 according to National Institute of Statistics (ECAM I and II).

	1996		2001	
	Urban	Rural	Urban	Rural
Poor	61.4	9.6	68.2	14.9
Non-poor	82.9	13.6	91.0	29.0
Total	76.3	11.7	88.2	23.4

Source: National Institute of Statistics (ECAM I and II).

According to a survey carried out in 2003 for the Rural Electricity Agency, all the Division Chief-towns were connected to an electricity line, whereas only 88 out of 272 Subdivision Chief-towns were connected, and 44 out of 56 Districts were connected. Since the beginning of the 2000s, AES Sonel has been aiming to increase the production level to match the current demand and to provide for future demand that is growing at an estimated 5% per year due to the increase in the number of subscribers and increased demand from existing customers due to economic growth.

As previously mentioned, 45% of the total electricity generated is consumed by high voltage customers. Alucam uses approximately 43% and is the single largest consumer of electricity in the country with the total annual load requirement of 145-165MW.

3.1.2 Need for the Project

The electricity infrastructure in Cameroon is dominated by the Southern Interconnected Grid (SIG). There is also an independent, northern grid as well as a significant number of off-grid 'remote' generating stations supplying power to major townships. The existing electricity network is illustrated in Figure 1.1.3. Generation within the SIG is predominately produced from the hydroelectricity producing facilities, which between them generate circa 90% of the power requirements of the SIG. The SIG has a daily average demand of circa 475MW with a peak demand around 610MW. Due to the large variability of natural flows on the river (over 6,000 m³/s during the wet season and less than 100 m³/s during the dry season), three upstream storage dams have been built to regulate flows during the dry season. In addition to the hydro capacity of circa 665MW on the southern grid, the SIG has six thermal plants with a total installed capacity of circa 170MW to provide additional power mainly for system security and peaking.

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The demand growth on the SIG in conjunction with lower than average hydrology resulted in severe power shortages and recurrent dry season load shedding during the three years up to 2004. To help solve this problem, in 2002 - 2003 AES Sonel built several small high speed diesel plants totalling 47MW and an 85MW heavy fuel oil (HFO) plant at Limbe. They were commissioned in September 2004.

Various additional hydro projects, including Lom Pangar reservoir to further regulate the flow in the Sanaga River, are under consideration by the Government. However, these projects are running behind schedule and are now not expected to be operational before 2013. Other projects for the longer term are also under consideration but, with an increase in public sector demand of about 6% per year, there is a need to build new production facilities in order to satisfy the mid-term demand and provide greater security for the electricity supply.

In 2006, 95% of the countries energy was produced from hydro power. Presently the water levels and flow rates are reducing putting additional strain on the already overburdened electricity system.

In addition to this public sector growth, Alucam plans to extend its operation and will require at least an additional 50MW over the next few years. The expansion of this major industrial process is considered very important for the economic growth of Cameroon.

The combination of the Kribi and Dibamba projects is planned to assist in the shortfall of the energy supply and will contribute a total of 238MW to the SIG. The two projects will enable AES Sonel to carry out much needed repairs on the aging hydro-power system and in some instances update the hydro power technology to increase power output.

The 150MW Kribi gas-fired power project is to be constructed to meet the long term demand and provide greater grid security. The project is currently scheduled for commissioning in early 2010. However, the load shedding situation which occurred in the dry season of 2005/6 and 2006/7 must be improved upon. The 88MW Dibamba Thermal Power Project is proposed for emergency peaking and back-up capacity to alleviate load shedding in the dry season caused by (i) growing demand; (ii) insufficient thermal capacity to enable optimal water resource management; and (iii) delays in the construction of the Kribi gas-fired power project.

The Dibamba Power Project will be owned by KPDC which is owned by AES Corporation and the Government of Cameroon. All the electricity produced will be delivered to the SIG through a Tolling Agreement (TA) between AES Sonel and KPDC.

3.2 PROJECT SETTING

3.2.1 Location

The entire project will be located in the equatorial region of Cameroon within the Littoral Province (see Figure 1.1.1 and 1.1.2).

The power plant and transmission line will be located in Yassa (see Figure 1.1.2), a village situated approximately 20km east of Douala, the economic capital of Cameroon. The electricity produced at the power plant will be transmitted through a 1.8km, 90kV transmission line to an already existing transmission line that runs directly to the Ngodi-

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Bekoko substation. The new transmission line has been designed in such a way so as to have a minimal impact on the local community and their residential properties whilst taking the shortest route possible.

3.2.2 Topography

The project area is entirely within the coastal lowlands of western Cameroon (see Figures 1.1.1 and 1.1.2). This area consists of flat alluvial coastal plains with mangrove and forest cover leading into slightly higher gently undulating lowland hills.

The project area is primarily within the lowland hills with a rural landscape of disturbed agricultural land, fallow and shrub habitats. The topography is one of low rolling hills or hillocks and shallow valleys. The plant site lies at approximately 45m to 57m above sea level whilst the 1.8km transmission line is generally 31m - 55m above sea level. Land clearance, associated with village activities (e.g. agriculture), is present along the transmission line route. There is little natural forest vegetation remaining.

3.2.3 Climate

The entire project is located in the equatorial region of Cameroon, largely characterised by primary and secondary forests, with average temperatures of about 28°C and humidity between 60 and 100%.

Generally the area has a dry season from November to March, light rains from April to May and a rainy season from June to October (West, 2004). The site and transmission line corridor has a high average annual rainfall of approximately 4,000mm.

3.2.4 Geology and Soils

The soils are generally deep intensively weathered materials with sandy surface horizons becoming more clayey with depth. Soils are physically stable and well structured giving good drainage characteristics with relatively high permeabilities. However, chemically the soils are poor with low pH values, poor nutrient status and low cation exchange capacities. Nutrients are therefore easily leached from these soils. Iron and aluminium oxides concentrations exist leading to the yellowish or reddish soils colours. In the valleys more waterlogged gley soils exist.

Due to this poor nutrient status, soils tend to be used for shifting agricultural and need artificial fertiliser if permanent farming is to be practised. Land use capability is therefore low.

3.2.5 Hydrology and Hydrogeology

The hydrology of the area is dominated by the Dibamba River approximately 2km east of the project area within the Kambo River Basin. The project area is characterised by low-lying, gently rolling hillocks with numerous small streams and rivers running within shallow valleys. Due to the relatively high rainfall in the region (4,000mm peaking in May and October) and low lying topography an extensive network of small tributary streams and rivers exists discharging to the main channels. The catchment draining the largest part of the project area is that of the Dibamba River which eventually discharges into the Cameroon

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Estuary and Atlantic Ocean south west of Douala. The site itself naturally drains to the south-east.

At present, a groundwater survey has not been completed so the depth and quality are unknown. AES Sonel does, however, anticipate that the borehole will need to be in the region of 80m below ground level. Once the borehole has been drilled AES Sonel will complete various water quality tests.

3.2.6 Land use

Land use, both within the plant site area and along the transmission line corridor, is subsistence agriculture, fallow ground and regenerating secondary scrub. Fallow areas are generally covered with pioneer vegetation and have a low conservation value. Sensitive plants and most trees have been destroyed by the 'slash and burn' agricultural system.

3.2.7 Socio-economic Framework

National Socio-economic Context

Cameroon is situated in Central Africa, located between 2 to 3 degrees of latitude north and 9 to 16 degrees longitude east. It has a total surface area of 475,650km² and a population estimated at approximately 16 million in 2005¹ which gives a density of about 33 inhabitants per km². The population has an average growth rate of 2.6% per annum. The life expectancy was estimated at 52 years in 1999 by the National Institute of Statistics (NIS), Cameroon. Cameroon has a youthful population with more than half of the population being below 25 years.

The country has about 276 ethnic groups. There is a wide range of geographical diversity with three main ecological zones: the forest zone, the western highlands and Saharan zone.

Although most of the country relies on agriculture, livestock, fishing, industry and services, agriculture has been, and is still, the largest sector of the Cameroonian economy; it always accounts for about 30% of the GDP. However, agriculture still employs about 75% of the total population, generates about 25% of export earnings, and contributes to about 17% of state revenues according to the annual statistics published by the NIS.

Cameroon experienced an economic boom in the 1980s due essentially to the exportation of agricultural products and petroleum. However, this was followed by a serious economic downturn resulting from the devaluation of the CFA franc in 1994 leading to reduction of export prices, the difficulties faced by private and state-owned enterprises, etc.

Some of the major consequences of the economic crisis included the withdrawal of administrative authorities from many sectors of activities, the increase in number of people living under the poverty threshold and the failure of many enterprises. Also, during that same period of crisis, per capita income halved and poverty increased sharply. Due to lack of financial means for investment, the country experienced deterioration in its educational and health systems. Consequently, education quality and enrolment rates significantly deteriorated and the health indicators worsened.

¹ World Population Prospects: The 2004 Revision, United Nations Population Division, Department of Economic and Social Affairs, New York, 2005 (WHO website, accessed 2007).

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A number of measures centred on monetary adjustments like currency devaluation and public sector reformation were taken to fight against the economic crisis. As a result, the economic situation began to improve from 1994, with the growth rate returning positive to 5% in 1996 (NIS Annual Statistics, 1997). However, the economic situation remains unsatisfactory because the growth rate is still low and there is no 'trickle down' effect. With the support of international donors and other development partners, the Government of Cameroon (GOC) is developing a strategy to fight poverty and boost growth. The aim through the Poverty Reduction Strategy Plan, is to effectively improve the living conditions of the population in a sustainable manner. In this way the GOC intends to implement an economic growth and poverty reduction policy that will help reach the United Nations Millennium Development Goals (MDGs). Cameroon was admitted to the HIPC initiative² on 27 April 2006.

Political Structure

Cameroon is organised into different administrative structures ranging from provinces to villages. There are:

- 10 Provinces headed by the Governors;
- 58 Divisions headed by Senior Divisional Officers;
- 260 Subdivisions headed by Subdivisional Officers;
- 54 Districts are headed by District Heads; and
- Villages headed by Traditional Chiefs.

With regard to villages, there are three classes of Chiefdoms: first, second and third class. The first and second-class Chief can cover more than a village, whilst the third degree Chief covers either a village or a quarter of a higher-class village.

Councils, headed by mayors, are the representatives of de-centralised local communities that fit into Districts, Subdivisions and some big towns. The Cameroon 1996 constitution makes provision for the transformation of provinces into autonomous regions with representatives being elected locally to conduct their respective duties.

The project area is located in the Littoral Province. The Littoral Province, made of four divisions (Moungo, Nkam, Sanaga-Maritime and Wouri), has a total surface area of 20,248km², and a population estimated in 2003 at 2,140,880 inhabitants (estimations by NIS) with a density of 106 inhabitants per km². The main economic activities of the rural populations in the province are palm oil, banana, tea, cocoa and coffee production and fishing. Douala is the main economic capital of the country. The project is located within the Douala III Subdivision in the Douala Urban Council (see Figure 3.2.1). Douala III is known for being the industrial section of Douala.

²HIPC was proposed by the World Bank and IMF and agreed by governments around the world in the autumn of 1996. It is the first comprehensive approach to reduce the external debt of the world's poorest, most heavily indebted countries.

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The Dibamba Power Plant is located at Yassa, the transmission line crosses the Yassa village.

3.3 PROJECT DESCRIPTION

3.3.1 Project Components

The Dibamba Thermal Power Project comprises of the following components:

- The construction of a 88MW power plant fuelled with heavy fuel oil (HFO) at the site in Yassa village; and
- the construction of energy transmission facilities, including:
 - (i) A step-up substation at the plant site (11 to 90kV) at the plant site; and
 - (ii) A 1.8km 90kV double circuit transmission line between the plant and a connection to existing 90kV transmission lines which run to Ngodi-Bekoko substation at Bekoko.

3.3.2 The Power Station

The Site

The site at Yassa, is located close to the main Douala-Edéa road, approximately 2km from the Dibamba River and 20km east of the city of Douala (see Figure 1.1.2) in the Douala III subdivision known in Cameroon for its industry.

The plant site in Yassa occupies an area of 7.7ha although the power plant site itself will only require approximately 4ha once constructed (see Figure 3.3.1). However, the larger site allows for the construction compound, as well as the plant itself and provides a buffer of land to best reduce potential impacts.

As stated in Section 3.2, the land surface on site is gently sloping from the northwest to the south east with a height varying between approximately 45m and 57m above sea level. The site is predominantly agricultural plantings, old fallow (covered with pioneer vegetation), and regenerating secondary scrub but no true forest or trees of significant size. There are no buildings or structures on the site.

One watercourse of note within the immediate surrounding area is a stream to the east of the site and drains south to the Dibamba River, which meanders approximately 2km to the east and south of the project site. The stream is understood to flow throughout the year; one source of the stream is the effluent from the soap factory immediately to the north of the site. The stream is used by local inhabitants as a water supply. The Dibamba River is the main watercourse near the project area and has substantial annual flows.

The land of the plant site is under title and AES Sonel is purchasing the rights to the land ownership.

Access Road

The plant site is located along the Douala-Edéa main road, which is fully tarred and in

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general in good condition. This road has a minimum carriageway width of 7m and surfaced verges of up to 1m. Current traffic volumes are relatively low with indicative selective surveys (carried out in 2007) identifying morning (am) and afternoon (pm) hourly movements between 216 – 275 vehicles (see Section 5.5).

There is a need to construct a new access road from the main road to the plant site. This will involve the upgrading of an existing dirt track (see Photo 5.5.2) to a 9m by 800m tarmac road.

For the construction phase, all main plant and equipment will be imported via the port at Douala. Cement and other manufactured construction materials will be sourced from Douala. The vehicles carrying equipment and materials will therefore travel from Douala to Yassa village, along the main Douala-Edéa road.

Power plant systems

All equipment and systems for the power station, excluding the step-up substation and transmission lines, are to be provided by Wärtsilä, an internationally recognised Finnish company whose equipment is designed, constructed and operated to the highest international standards including ISO9000, ISO14001 and OHS18001/BS8800.

The main systems that will be included can be seen in Figure 3.3.1 and are as follows, see Table 3.3.1:

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Table 3.3.1: Power Station Systems

Primary System	Secondary System	Tertiary System	Function
Mechanical auxiliary systems	Fuel system	-	The main function of the fuel system is to provide the engine with fuel of the correct flow, pressure, temperature, viscosity and purity. This is particularly important for HFO which must be run through the fuel system so as to increase its temperature which results in a reduction in viscosity, thus enabling it to be cleaned prior to being burnt in the engines
		Light fuel oil system	The main function of this system is during start up when the HFO system is not heated to operational temperature, as well as acting as a back up for the HFO system and to be used as a flushing fluid prior to maintenance work being undertaken
		Heavy fuel oil system	HFO is the main fuel for the power station. The system delivers HFO to the engines, a preheated engine can be started using HFO provided the fuel has been circulated through the fuel system and is at the correct temperature, pressure and viscosity. The engine can only be stopped on HFO if it can be circulated through the engine and kept at the required temperature
	Lubricating oil system	-	This system provides the required lubrication for all the moving parts on the engine
	Compressed air system	-	This system is used to start the engines as well as controlling the instrument air
	Cooling system	-	The main purpose of this system is to cool the critical engine components as well as cooling the lubrication oil and charge air (air used in the burning process). It is a closed loop system and should be drained and cleaning when necessary but not exceeding 2 years

Section 3: The Project

Table 3.3.1: Power Station Systems

Primary System	Secondary System	Tertiary System	Function
	Charge air system	-	The purpose of the system is to protect the engine against impurities in the inlet air. It also reduces the air intake noise from the engine; Exhaust system – This system includes the exhaust gas silencer and stack pipe and is how the exhaust gas from the engine is discharged. The stack is made from Corten B and the silencer reduces the noise from the engine exhaust outlet to 35dB(A)
	Station support systems	Oily water system	The function of this system is to collect the oily water that is produced as a by-product from the burning process and separate it into treated water that can be discharged after treating with coagulant and flocculants in a flotation basin and sludge which is collected in the sludge tank for further treatment offsite
		Water treatment system	The water treatment system uses the borehole water and provides the power station systems with water of the right amount, pressure and quality. It consists of a water treatment unit (which ensures the water is of the correct purity), a storage tank, and a booster unit to distribute water through the plant
		Fire fighting system	This system is designed by Wärtsilä and includes two pumps, one which is powered by diesel and one which is powered by electricity. Water for the system is provided by a separate borehole from the one used in the water treatment system
Electrical system	-	-	Supports the electrical systems required to control the power station
Automation system	-	-	This is the automatic computer system that is used to control and supervise the system whole engineering process to ensure a safe, reliable, efficient and easy operation of the generating sets and their associated auxiliary and electrical systems

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Power station equipment

The systems mentioned above are made up of numerous pieces of equipment. The key equipment that is to be installed can be seen in Figure 3.3.1 and are highlighted below in Table 3.3.2.

Table 3.3.2: Power Station Equipment	
Item	Description
Exhaust stacks	There are 8 stacks, one for each engine. Stacks will be grouped 2 into groups of 4, and will be 40m in height.
Cooling water radiator	There are 24 of these all of which are 4m above ground level
Low temperature water expansion vessel	There are 4 of these which will have a volume capacity of 0.6m ³ and will be 10m above ground level
High temperature water expansion vessel	As with the low temperature water expansion vessels there are 4 of these which will have a volume capacity of 0.6m ³ and will be 10m above ground level
Exhaust gas silencer	There will be 8 of these, one for each stack. They are located 4.57m above ground level
Oily water collecting sump	There are 4 of these each with a 2.5m ³ capacity
Water treatment container	This is part of the water treatment system
Treated water tank	This stores the water that has been through the water treatment prior to discharge. The volume of the tank will be 300m ³ . There is one on site
Fire/raw water tank	The volume of this tank is 600m ³ . It contains water from the borehole that is dedicated for the fire fighting system. There is one on site
Fire fighting container	Is an integral part of the fire fighting system
Septic tank	All of the waste water from various utilities is collected in the septic tank prior to a contractor collecting it for off site disposal. There is one on site that has the capacity to store 10m ³ of effluent
HFO storage tank	There are 2 tanks, each with a capacity of 3000m ³
HFO system associated equipment	Equipment that will be installed to run with the HFO system include three unloading pump units, one buffer tank (200m ³) and one HFO day tank (300m ³)
LFO storage tank	There is one tank with a capacity of 500m ³
LFO system associated equipment	Equipment that will be installed to run with the LFO system include one unloading pump unit

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Table 3.3.2: Power Station Equipment	
Item	Description
Lube oil tanks	One clean lube oil tank with a volume of 80m ³ , one used lube oil tank with a volume of 35m ³ and one lube oil service tank with a storage capacity of 16m ³
Sludge tank	As part of the fuel system the sludge tank will collect all the waste sludge from the fuel burning process ready for collection and disposal off site. The volume of the tank is 55m ³
Oily water buffer tank	This tank has a capacity of 55m ³ and is also part of the fuel system

The base case design for the power plant will involve the installation of eight 11MW 18V38 Wärtsilä engines. The plant's total site output will be 88MW. The engines will be grouped in two sets of four and housed in separate power houses. The eight generators will have individual emission stacks grouped into two sets of four. The stacks will be 40m tall.

The plant will use light fuel oil (LFO) as a start up fuel but burn heavy fuel oil (HFO) as the main source supplied from the oil refinery at Limbe, approximately 120km away. HFO will be supplied to the site via 30m³ road tankers using the main Limbe-Douala-Edéa road. Approximately 12 road tankers are anticipated per day during peak operating conditions of the plant.

On-site storage tank capacity for HFO is based on running the plant for 14 days at full capacity. As an emergency back up LFO can also be used as fuel, in this instance the plant will be able to run for just over 1 day at full capacity.

Step-up substation

Power will be exported from the site via a new 90kV transmission line running west to connect to an existing 90kV line which runs to the Ngodi-Bekoko substation at Bekoko. A step-up substation equipped with 11/90kV power transformers will be constructed within the switchyard at the power plant, (see Figure 3.3.1) for connection to the transmission line.

At the Ngodi-Bekoko substation at Bekoko, new 90kV bays will be added to connect the new line to the existing grid. This will include an extension of the existing 225kV busbars³ system. No new land take is required for the additional busbars, as sufficient space is available within the existing substation site for this development.

The step-up substation contract is currently out to tender but will be provided by an internationally recognised company whose equipment is designed, constructed and operated to the highest international standards.

³ A busbar is a heavy conductor, often made of copper in the shape of a bar, used to collect, carry, and distribute powerful electric currents, as those produced by generators.

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Ancillary buildings

The plant site (see Figure 3.3.1) will also include a utility house, which will contain within it offices, control room, switchgear room, canteen, staff changing and welfare facilities. In addition to the utility house, the site will have a separate building housing the workshop and warehouse. Both these structures are to be located to the north of the powerhouses in the northern section of the operational site.

Load demand

The peak daily load demand on the SIG occurs between 1800 hrs to 2200 hrs. On a seasonal basis the main load period is the dry season, (January to June), with lower demand during the rains (July to December).

The power plant will therefore be designed to provide peak load to the grid up to the maximum 88MW. It is currently envisaged that the following operating scenario as outlined in Table 3.3.3 will occur.

Table 3.3.3: Power Station Load Profile		
Season (months)	Number of Engines Operating at 100%	
	1700-2300	2300-1700
Dry (January – June)	8	2
Rainy (July – December)	4	1

At least 1 generator unit will operate the whole year, and all the plant will run 100% daily between 1700 hrs to 2300 hrs at a load of 88MW during the dry season. The intention is to only run the plant at its peak load only during the driest periods.

The Transmission Line

As with the step-up substation, the tender for the transmission line will be awarded to an internationally recognised company whose equipment is designed, constructed and operated to the highest international standards.

The main features of the transmission line, which will be used to export the produced energy to the interconnected grid, are summarised in Table 3.3.4.

Table 3.3.4: Transmission Line Specifications (base case design)	
Item	Specification
Voltage	90kV
Type	Overhead double circuit
Pylons	Self supporting steel towers
Phase Conductors	3 x 366mm ² (ASTER)

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Table 3.3.4: Transmission Line Specifications (base case design)	
Item	Specification
Earth Conductors	Fibre optic OPGW cable
Total Length	1.8km
Width of Wayleave Corridor	30m
Number of Summits	15 Maximum

The towers to be used will range from 29-36m in height depending on the topography. The tower design is as shown in Figure 3.3.2. The nominal spacing of the towers will be 100m, although this may vary from 100-300m depending upon the terrain.

The new transmission line will follow an east to west orientation running parallel to the main Douala - Edéa road, on its south side. From leaving the substation at the power station the route runs over the access road and immediately north of a dirt track for approximately 600m, the route subsequently doglegs north by approximately 200m to avoid residential properties where it continues west for a further 800m (see Figure 1.1.4). It crosses the main road to the south of Yassa junction. Prior to connecting to the existing 90kV that runs to Ngodi-Bekoko substation it has to cross another existing 90kV line.

Access to the majority of the line corridor will therefore be easily undertaken from minor trackways and the main road. Main trafficking from tower to tower will be via an internal haul route aligned along the wayleave corridor.

Predominantly the selected route passes through subsistence agriculture, fallow land, and regenerating secondary scrub. Fallow areas are generally covered with pioneer vegetation. To the east of Yassa junction the line passes between Yassa weighbridge station and a warehouse facility. The area is sparsely inhabited, and this route was selected to avoid, as much as possible, crossing the residences in the village.

3.3.3 Construction Phase

Programme

The overall construction timeframe for the whole project is in two phases. Firstly, preparation of the site, installation of all ancillary equipment and structures, including four generators. Secondly, installation of a further four generators. At the present time, AES Sonel hopes to power up the first four generator set by mid 2008 with the second generators coming online in early 2009. The first phase is estimated to take 9 months. The second phase is estimated to take 6 months. The transmission line will be constructed within the same construction phase as the first phase of plant site construction and is expected to take 8 months to complete.

At the plant site all construction operations will be focused in the one area. It is understood that the typical transmission line construction methods involve erection and wiring of up to 10 towers at a time, therefore the transmission line will be erected in one to two sections. The maximum number of towers will be approximately 15. Should installation be possible in only one section then it will take approximately four to six weeks to complete, if two sections are required then it will take approximately six to nine weeks.

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Construction overview

During the construction phase, the key operations to be conducted at the Yassa site are as follows:

- *Land clearance* – Including removal of vegetation from the construction areas and compensation of any crops / farm land within the site. Land grubbing operation will be either by hand or by machinery, such as bulldozers;
- *Site access and construction compound* – Establishment will involve land levelling and construction of temporary building, fencing of the site and grading and surfacing of the new access road to the site from the main Douala - Edéa highway.
- *Groundwork and foundation* - Including land levelling and excavation to provide appropriate foundation and constructions levels, erecting of shuttering, etc. for raised concrete structures and placement of concrete;
- *Plant and equipment* - Importation of main electrical and mechanical plant (turbines, storage tanks, etc.) and installation on site. All main equipment to be imported via the port at Douala. Switchyard equipment, including switch gear and transformers will be installed on site.
- *Construction of utility building, office, workshops, plant housing, car parking and ancillary buildings;*
- *Commissioning of the power plant;* and
- *Decommissioning* of the construction compound and revegetation of the compound area.

Along the transmission line, the main construction activities will take place at the same time as the construction at the plant site, and are as follows;

- *Clearance of the wayleave and access tracks* of all trees and tall vegetation and compensation of any farm land (see Section 6);
- *Excavation for and placement of concrete pads* for tower foundations (one concrete pad at base of each leg);
- *Importation of steel works*, isolator and related materials and erection and fitting of tower at each site (up to 15 towers for this route of 1.8km);
- *Stringing and tensioning of tower sections* with conductors and earth wires using equipment and methods to ensure conductors are not damaged or come into contact with the ground; and
- *Clearance of equipment and waste materials* from site once works complete.

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Employment

During the construction phase employment levels will vary but are anticipated to peak at around 480 workers. These will range from manual labourers, through electrical, mechanical and civil technicians and engineers, to site managers. The anticipated split between national and expatriate workers is 95% to 5% respectively with a proportion of the workforce are expected to be sourced locally.

Employment from the local area will be encouraged. However, given the quantity and skills of workers needed during the construction phase, it will be necessary to import some manpower from neighbouring cities where the appropriate skill base exists (e.g. Douala, Yaounde, Edéa, Limbe). Security will be required for the wayleave and project site during the construction and operational phase. Exact numbers of required people are still to be confirmed.

Accommodation and logistics

Due to the vicinity of the town of Douala (approx. 20km from the project site), it is anticipated that the majority of the construction workers will live in Douala, and predominantly be in existing accommodation in Douala. It is assumed for the purposes of this ESIA that no new accommodation will be required. The construction contractors will organise the transportation of their staff from Douala to the project site, as there is no formal public transportation in the area. Whilst on site, the contractor will ensure that suitable welfare facilities are provided for all workers.

Works compound and materials storage

During the design development, the size of the plant has increased for numerous reasons. One of the reasons was to enable a works compound and for materials storage to be included on site. This additional area is referred to in this report at the non-operational area of the site. The plant site as a whole is 7.7ha, the operational site (where the power station will be) is 4ha therefore the remaining non-operational site is 3.7ha which is sufficient for all the construction plant and transmission line materials to be stored as well as temporary offices and facilities for the construction workers.

At site establishment all vegetation from the plant site itself and the construction compound will be cleared and removed from site, the whole area will then be fenced. Any crops and useable timber will either be sold or given to local residents, whilst other unusable vegetation materials will be left on the periphery of the site to naturally degrade. Works will be set out to keep the area of land utilised for the project to the minimum and, where practical, mature trees and a vegetation screen to the road and properties will be maintained.

Any excess materials resulting from site levelling, landscaping and backfilling will be stockpiled on the periphery of the site at a designated area. For the transmission line, it is planned that surplus material will be spread over the adjacent area as only small volumes will be involved. Excess material would be removed to appropriate disposal sites. The details of the disposal sites will be included within the Environmental Management Plan (EMP) and form part of the contractual obligation of the Engineering, Procurement and Construction (EPC) contractor. Items, such as wood, will be recycled as firewood for the use of local people, or given away as a community benefit where this is not possible then items may be sold by them to form a source of revenue.

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Construction water

Water for the construction phase of the project will be taken primarily from on-site boreholes. Additional supplies will be trucked to site. The borehole water quality will be analysed before the final decision of use. It is anticipated that there will be a relatively low water demand during the construction phase with only 10-20m³ required each day. The impact on the resource will be minimal (see Section 5.6).

The main construction water demand for the transmission line will be for the production of the concrete for the tower foundations. The foundations consist of a single concrete pad cast at the foot of each leg (four per tower). The concrete will be trucked in from Douala. Most construction activity at the transmission line will include the assembly of the towers, fitting of isolators, stringing all activities where there is no construction water demand.

Potable water will be provided either as bottled water or from a borehole at the plant site. Appropriate sanitation facilities such as portable toilets or pit latrines will be provided at various locations around the construction sites (including the transmission line).

Wayleave clearance

As set out within Table 3.3.4 the wayleave for the new 90kV line will have a total width of 30 m, i.e. 15 m either side of the centre of the power line. During construction, this wayleave will be cleared of all trees and tall vegetation. In addition, there will be a need to fell all trees greater than 15m that are located along the boundary of the wayleave. All clearance will be undertaken using a combination of hand work and machinery with no use of chemicals. Vegetation will be left at ground level to ensure that no significant areas of bare ground are created.

In addition to vegetation clearance, all farming areas that exist within this wayleave will be relocated / compensated for. Procedures for the valuation, assessment and administration of any compensation to local property or land owners for this relocation will be in accordance with international guidance. Details of these procedures are set out within the Social Impact Assessment (Section 6).

As the transmission line route is agricultural plantings, old fallow and regenerating secondary scrub most clearance will involve removal of trees and under storey vegetation. The compound area will be the same as that utilised for the plant site.

Construction equipment and materials

Cement and reinforcement steel can be purchased in Douala. The aggregate quarry is at Logbadjek which is also in Littoral Province. Earthing cables are manufactured locally whilst materials such as timber, and sewerage pipes are all locally available. Materials that are not available locally will have to be imported.

The following materials will be sources locally, where possible:

- Concrete, rebar, formwork, gravel, crushed rock, concrete blocks, etc.;
- Sewage piping;
- Sanitary facility equipment;
- Electrical conduits;

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- Earthing (grounding) material (copper cables);
- Domestic electrical materials, lighting;
- Road surfacing material;
- Furniture; and
- Tank material.

Construction equipment will be sourced locally, wherever possible. Where this is not the case then, where possible, the equipment will be sourced from within Cameroon. In some circumstances the equipment may need to be imported. Where this is the case then it is the responsibility of the construction contractor to ensure that the equipment was not available in Cameroon.

Site preparation requires the following equipment:

- 4 Bulldozers;
- 3 Compactors;
- 2 Graders;
- 2 Excavator;
- 4 Frontloader; and
- 2 Trucks.

During the civil works the following equipment will be used:

- 2 Excavators;
- 3 Motor Compactors; and
- 2 Cranes.

For the electromechanical and piping installation the following equipment will be used:

- Approx. 2 cranes of different sizes;
- 2 truckcranes;
- 1 trailer truck;
- Various skylifts;
- Scaffolding;
- Welding machines;
- Small equipment and hand tools; and
- Welding machines.

Equipment required for the tank installation includes:

- 1 Crane;
- Welding machines, including automatic welding equipment; and
- Small equipment and tools.

3.3.4 Operational Phase

Employment

The operation of the power plant will require approximately 34 specialised staff, mainly engineers and technicians with an additional 6 security personnel. As AES Sonel has

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experience of operation and maintenance of this technology in Cameroon (i.e. from Limbe), AES Sonel will utilise experienced staff as well as recruiting new staff early in the construction process for extensive training, it is anticipated this process will occur 6 months prior to operation commencing. Recruitment will be countrywide, however, some non-specialised jobs such as guards, and cleaners will be filled locally.

The power plant will operate at its highest capacity for 6 hours per day (1700 hrs to 2300 hrs) and will be staffed through three, 8-hour shifts. Where necessary, the plant may need to operate outside these 6 hours at full capacity as requested by AES Sonel. Approximately 4 staff per shift will be required to run and operate the plant, with 16 maintenance staff during the day shift to maintain plant and equipment. It is anticipated that 1 operational and 1 maintenance manager will be required on-site during the day shift. This does not include employment associated with the maintenance of the wayleave, which is discussed below.

KPDC's Health and Safety, Employment and Labour policies are being developed at the present time.

Accommodation and logistics

There will be no staff housing provided at the plant site as the neighbouring town of Douala is only 20km to the west of the site. The company will provide staff transportation to and from the site at the beginning and end of each shift.

The plant will have office accommodation and staff welfare facilities, toilets, washing/changing facilities and a canteen/eating area on site. As previously mentioned, these will be located in the utilities building.

Water Supply

Water supply at the site will be designed to satisfy the potable and staff welfare requirements at the plant as well as process water demand.

There is no local potable water distribution system close to the site. As a consequence potable water will be provided primarily via 2 groundwater boreholes constructed on site. Groundwater levels, quality and volumes will be established prior to final design of the supply system. Water quality analysis, once the boreholes have been created, will identify the need for any water treatment to meet drinking water standards. Final design of the potable system has not been completed. However, based on the staff numbers potable water demand is anticipated to be low, in the order of approximately 2-3m³ per day (see Section 5.6).

There is also no major water demand required for the power generation operations on site as the water cooling systems for the generators will be closed loop circuits. Overall water demand for the process operations is estimated at only 2-3m³ per month. Process water for the system will be supplied from on-site boreholes.

Waste water management

All potentially contaminated water from the process will be collected and treated with flocculants and coagulants prior to being discharged to a soak-away system or to the

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drainage ditches surrounding the plant site. For the on-site welfare facilities, foul drainage will be feed to a septic tank for collection and off site treatment.

Wayleave Management

During the operational phase, vegetation within the wayleave must be managed to ensure that it does not interfere with the line (see Section 3.3.5). This operation will be conducted under contract to AES Sonel with contractors utilising local labour for the works in accordance with good industry practices.

Future Fuel Supply

There is the potential to convert the plant fuel to gas in the future.

3.3.5 Wayleave management

The client has agreed that informal cropping up to a height of 2m will be allowed within the wayleave.

Vegetation management

Within this wayleave all tall (suggested as greater than 2m) vegetation must be cleared. At the establishment phase all woodland and tall scrub will therefore be cut and removed. After construction, vegetation management will be undertaken once per year with the vegetation cut back to a minimum height of 40-60cm above ground surface, where necessary. The clearance will be undertaken in such a manner so as to ensure that the vegetation cover survives and re-grows this will prevent erosion.

No burning of vegetation will be permitted within the wayleave as the soot and carbon can affect the power transmission lines. Good practices would be for all cut vegetation to be removed from the wayleave during clearance so as to reduce the build up of dry matter under the lines which may inadvertently be ignited and cause large fires. However, within the warm humid climate of the project site, vegetation may be left to rot and degrade within the wayleave. However, as part of the Environmental Management Plan (EMP), a review of build up of dry matter will be undertaken each year to ensure this degradation process is effective. Chemical defoliation will not be permitted.

Permitted land uses

Within these guidelines informal land uses, such as agriculture including livestock grazing, would be permitted within the wayleave. However, this would be subject to the following conditions:

- Crops greater than 2m in height **cannot** be grown;
- **No** burning activity for land clearance prior to planting, etc., is allowed; and
- **No** irrigation, overhead or low level, is allowed.

In effect these conditions would allow most normal agricultural activities to continue within the wayleave. However, fruit crops or other produce from trees or shrubs of greater than 2m in height, such as bananas and, oil palms would not be allowed. It should be noted that as the wayleave area will have been subject to a full Resettlement Action Plan (see

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Section 6.3), the farmers currently occupying this land will be compensated in advance by AES Sonel. Any subsequent farming undertaken during operation of the proposed line would be at the risk of the farmer as AES Sonel will reserve the right to clear the land as required for safety of the project.

No construction development of any sort, residential or otherwise, is permitted within the wayleave. All property must be constructed outside the 30m wayleave and where resettlement is being undertaken, new property should aim to be located away from the wayleave margins so as to allow for potential future development. However, local circumstances will dictate the actual relocation site of any property that needs to be moved.

3.3.6 Decommissioning

Power plant

The plant has a design life of 25 years after which time the future of the development will be defined, i.e. either to undertake repair and replacement to extend the life or to decommission the plant. At this stage, a detailed decommissioning plan will be developed.

The first stage of decommissioning will be to identify if any of the structures or buildings on site have an alternative long-term use. This may apply to the offices, workshops and plant houses that could be converted to new industrial and commercial uses. This decision process will be undertaken in consultation with the government and local communities and any buildings and structures to be retained will be identified and transferred to a suitable new owner. Any conversion works to be undertaken will be specified at the time of decommissioning.

Following this process, the main power plant and electrical equipment will be dismantled and all steel and other reusable materials removed from site and recycled. All unwanted concrete foundations, and car park areas will then be broken up and removed from site. Where volumes and demand allows these may be crushed (with reinforcing bar recovered) and reused as a construction aggregate. If this is not practical then all materials will be removed from site and disposed of to a suitable designated waste disposal site.

Following dismantling and removal of buildings, soils will be tested for any contamination arising from the activities conducted on site. Where contamination is identified, these soils will either be treated to remove the contamination or disposed of to a suitable waste disposals facility. The re-grading and earthworks associated with the development of this site will result in the loss or damage of the soil profile. Following decommissioning, the soil surface will be ploughed to aerate the soils in preparation for re-planting. Soils will be in a relatively poor state and therefore the site is likely to be returned to its current use.

Final decisions on land use at the site, post closure, will be taken nearer the time of decommissioning and in light of any decisions on the retention and conversion of any structures on site. The water supply borehole(s) at the plant site could be made available to the local community.

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Transmission line

The typical life of a transmission line is 50 years and therefore decommissioning is not defined in detail at this stage. The potential exists for repair and replacement and therefore this timescale may be extended.

At decommissioning, the conductors will be lowered and removed from site for recycling and reuse. Following this the tower will be dismantled and the steel also removed and recycled. Limited waste will be produced during this operation although some isolators, and electrical equipment may need to be disposed of. This will be removed from site and then disposed of to a suitably designated facility.

The need to remove the concrete tower foundations will be dependent on the future land use of the site following decommissioning. Where the wayleave is to be returned to forest cover these foundations may be left in place. If agriculture is to be practised then it will be more appropriate for them to be removed. This will need to be defined nearer the time of decommissioning.

As the development involves little disturbance of the actual soils and land within the wayleave (only at the tower sites), final land uses following decommissioning are not restricted.

3.4 CONSIDERATION OF PROJECT ALTERNATIVES

In line with IFC and AfDB guidance and international best practice a number of alternatives have been considered for the power station and associated transmission line.

3.4.1 Plant alternatives

Studies of alternative options for providing the load requirements were carried out in 2006 and 2007 by AES Sonel. These studies included:

Location alternatives: *8 Sites were reviewed 3 Barge Mount installations and 5 Land Based installations*

Plant type alternatives: *HFO engines, gas engines and gas turbines*

Fuel alternatives: *HFO 1500, 380 and 180*

Transmission line route and cable type for the chosen location; *90kV verses 225kV*

The conclusion of the study was that a thermal power plant located at Dibamba and equipped with eight 18V46 Wärtsilä engines fuelled with HFO 180 supplied from Limbe was the most economic, environmentally and socially viable option. A copy of the presentation on the site selection process is attached as Appendix C to this report.

3.4.2 Plant Site

Following the initial decision that a thermal power plant around Dibamba, fuelled with HFO coming from Limbe oil refinery, a site selection survey was undertaken for the potential plant site. An AES Sonel team undertook this survey in 2007.

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The location of the plant site is significantly influenced by the noise impact on sensitive receptors and the length of the transmission line, to reduce electricity loss due to transport through lines. Eight potential sites were investigated:

Three barge based;

- Barge option at Sanaga River in Edéa;
- Dibamba river barge option; and
- Deido / Wouri area at Douala Port.

Five land based:

- Bekoko substation at Douala;
- Edéa substation at grid dispatch centre;
- Dibamba near Yassa Village;
- Nogodi Bekoko substation near Dibamba; and
- Limbe power plant extension.

The sites were assessed with respect to real estate, environmental constraints (particularly noise and air quality), interconnection, site access (equipment unloading, fuel and personnel access), fuel delivery and storage, and water availability. The conclusion of the survey was that Dibamba was the preferred site and the best option as it was near to Nogodi Bekoko Substation and there was sufficient land for the development.

3.4.3 Plant Type

HFO engines were chosen due to gas being currently unavailable in Cameroon. As well as the company having extensive operation experience with HFO due to plants at Limbe and Oyomadang in Younde.

3.4.4 Fuel Type

HFO was chosen as the operational fuel as gas is not available at present in Cameroon and LFO was not an economical choice.

3.4.5 Transmission Line

The route of the line is dictated by the location of the plant, connection to existing lines and related substation at Ngodi-Bekoko and the need to minimise the overall length wherever practicable.

However, various deviations along the route were investigated to minimise, and where possible, avoid existing houses, plantations and farmland falling within the wayleave. The area is lightly inhabited. As shown on Figure 1.1.4, the line has been designed to minimise the number of properties that are crossed. A framework Resettlement Action Plan (RAP)

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will be developed as part of the ESIA requirements (see Section 6.3). From the plant site, the selected route passes west to the south of the main Douala-Edéa road, but deviates north to avoid residences before continuing west to connect with an existing 90kV line near Yassa Junction.

Options for 90kV and 225kV transmission lines were also considered for this initial stage of development. Ultimately AES Sonel chose 90kV because with the long lead time of 225KV switchgear availability, it was also a more economic solution.

3.4.6 Assessment of Alternatives

As the Plant Site locations and transmission line route and cable alternatives have been considered in detail and reported separately, these are not considered as alternatives in the ESIA.

The ESIA will also examine the zero option (or no-go) project option (see Sections 5 and 6).

3.4.7 Do Nothing

The do nothing option has been considered but due to the clear need and anticipated increase in demand, as outlined at the beginning of this section, AES Sonel do not believe that doing nothing is feasible.

Section 4

Scoping and Consultation

SECTION 4 : SCOPING AND CONSULTATION

4.1 INTRODUCTION

Scoping and consultation is typically a cyclical or iterative process involving feedback and further consultations with relevant parties. The process, which is undertaken throughout the production of the ESIA, has two principal functions:

- To identify and clarify the key issues which must be addressed by the ESIA; and
- To ensure an adequate flow of information to regulatory authorities, interested parties and the general public, which is not only a necessary pre-requisite of the identification of the key issues, but is also an integral part of the permitting and approval processes practised by many permitting authorities and international funding agencies.

4.2 REQUIREMENTS FOR SCOPING AND CONSULTATION

4.2.1 Cameroonian Requirements

As discussed in Section 1, and summarised in Table 1.3.1, Cameroon's EIA regulations are defined in *EIA Decree of Cameroon, 2005/0577, 23rd February 2005*. In line with international EIA best practice, the regulations require a two-stage process to the EIA. The first stage (also referred to as scoping) requires the proponent to provide the Terms of Reference for the ESIA.

The decree also provides the following requirements for consultation:

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

In line with these requirements, public consultation has been undertaken for the Dibamba Thermal Power Project as discussed in Section 4.4.

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4.2.2 Requirements of International Agencies

Scoping

A scoping exercise was undertaken in line with the ‘World Bank Environmental Assessment Sourcebook 1999’¹ and IFC Guidance Note 1². The scope of the ESIA was established through a site visit and the Ministry-approved Terms of Reference (and Terms of Reference report).

It is considered best practice to initiate scoping during the early stages of an EIA (and SIA) in order to provide a focused EIA (and SIA) that meets the requirements of the relevant planning authorities

Consultation

Scoping should be undertaken with the involvement of relevant government agencies, non-governmental agencies and affected groups to ensure all the issues of significance to the community are considered³. Consultation on the draft EIA (and SIA) report is also required. Once consultation has been initiated, it is considered best practice, and is a requirement of IFC Performance Standards 1, 5, and 7⁴, to continue consultation throughout the project life.

4.3 SCOPING OF THE ESIA

4.3.1 Scoping Methodology

The overall objective of the scoping exercise was to provide project and site familiarisation and to gather and review existing baseline data in order to be able to identify the potential environmental and social impacts of the project, which needed detailed examination in the second phase – the ESIA itself.

Environmental and social impact scoping work was undertaken during and following visits to the site by the study team in September 2007. The site visits included discussion with the Ministry of Environment and Nature Protection, other relevant Ministry offices in Douala, AES Sonel’s staff and project team members to ensure the history of the project was understood and all available existing baseline data was collated. This initial study phase considered the potential environmental and social impacts of the project through its construction, operation and decommissioning phases. Consideration was also given to collating information on project alternatives, for example, options for the location of the power plant and the transmission line route.

¹ World Bank (1999) Environmental Assessment Sourcebook 1999. Available on [<http://siteresources.worldbank.org/INTSAFEPOL/1142947-1116495579739/20507372/Chapter1TheEnvironmentalReviewProcess.pdf>].

² International Finance Corporation (2007) Guidance Notes: Performance Standards on Social and Environmental Sustainability. Available on [[http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/pol_GuidanceNote2007_full/\\$FILE/2007+Updated+Guidance+Notes_full.pdf](http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/pol_GuidanceNote2007_full/$FILE/2007+Updated+Guidance+Notes_full.pdf)]

³ World Bank (1993) Environmental Assessment Sourcebook Update Number 5: Public Involvement in Environmental Assessment: Requirements, Opportunities and Issues.

⁴ International Finance Corporation (2006) Performance Standard 1: Social and Environmental Assessment and Management Systems; Performance Standard 5 (2006): Land Acquisition and Involuntary Resettlement; Performance Standard 7 (2006): Indigenous Peoples. All available on [<http://www.ifc.org/ifcext/enviro.nsf/Content/PerformanceStandards>].

Section 4: Scoping and Consultation

Information from the scoping stage was fed back to the design team for the project in order for provision to be made for optimising design with due regard to potential significant environmental effects. This included input to the Compensation Commission Survey that was to be undertaken to identify Project Affected Persons (PAPs), as discussed in Section 6.3.

4.3.2 ESIA Terms of Reference

The Terms of Reference (ToR) for the ESIA, i.e. the potentially significant environmental and social issues that were to be considered, were presented to the Ministry of Environment and Nature Protection by AES Sonel on 19th July 2007. The ToR were approved by the Ministry of Environment and Nature Protection, subject to a number of alterations on 21st August 2007, the approval and revised ToR are provided in Appendix D and E respectively.

It is emphasised that these are *potential impacts* and not necessarily those that are bound to be experienced. Identification of the potential impact allows the main environmental and social issues to be identified and early consideration given to mitigation of the impact via appropriate project design.

Table 4.3.1: Potentially significant environmental issues identified in ToR for inclusion in the ESIA	
Issue	Potentially significant issues for the EIA
Air quality	During construction, the use of construction equipment and vehicles will result in the emission of dust and fugitive emissions from construction plant and vehicles. Potential local, regional and wider scale air quality impacts from power plant stack emissions during the operational phase.
Noise	There will be noise associated with the preparation of the site and the movement of the power units onto the site. No significant operational impacts along the transmission line but potential impacts on the residents and soap factory from the plant noise.
Traffic	Potential impacts will arise as a result additional traffic during construction and operation. The construction phase will require transportation of the plant components and workforce to the site whilst the operational phase will involve the delivery of fuel.
Water Resources	Construction could alter the drainage characteristics of the site leading to surface water run-off. Spillage of fluids could contaminate the watercourses. Water injection may be required to abate nitrogen oxide emissions. Water resources will be a constraint given the current low river levels and low rainfall in the last three years.
Social and Socio-Economic	Potential impacts will arise from disturbance through an increase in noise, dust and traffic. Change in land use and land take required for the plant site and transmission line. Positive impacts include the potential provision of construction phase employment and a regular and reliable supply of electricity to the system
Landscape and visual	The power plant has the potential to result in an adverse visual impact due to the nature of the plant. However, as it will be located next to an existing soap factory the impact may be minimal.
Land use	The proposed plant will be located away from Douala. Additional infrastructure will need to be constructed. Potential issues relating to loss of agricultural land use.

Section 4: Scoping and Consultation

Issue	Potentially significant issues for the EIA
Flora and Fauna	There are no reserves affected by the project and no protected sites within the vicinity of the site. Potential adverse impacts may occur on aquatic flora and fauna from drainage of surface runoff containing contaminants. Production of wastewaters will be minimal and measures will be employed to minimise the potential for water contamination on the site. The project is unlikely to have a significant adverse impact on flora and fauna.
Cultural heritage	No known sites of cultural and archaeological importance were identified around the site and along the projected line corridor; some areas may have graves.

4.4 CONSULTATION

4.4.1 Introduction

This section provides an overview of the consultation carried out for the ESIA at the time of this report preparation. It also highlights some of the key issues raised and recommendations on the way forward.

4.4.2 Approach

Public consultation, according to the International Finance Corporation (IFC), “...is a tool for managing two-way communication between the project sponsor and the public. Its goal is to improve decision-making and build understanding by actively involving individuals, groups and organisations with a stake in the project. This involvement will increase a project’s long-term viability and enhance its benefits to locally affected people and other stakeholders.” (IFC, 1998). In accordance with IFC and World Bank guidelines, the project has placed consultation at the centre of its activities that affect the local community. The project’s philosophy is to regard consultation as an organic and dynamic process rather than a single event. A fundamental requirement in IFC/World Bank policies on resettlement, land acquisition and compensation is a framework for public consultation, participation, and the establishment of a process to redress the grievances of affected people. Consultation with the affected population and with officials of local government, civil society and other representatives of the affected population is essential for gaining a comprehensive understanding of the types and degrees of adverse effects.

Stakeholder involvement in both the project development and environmental decision-making provides valuable information on its social, economic and environmental implications. Through early, proactive and continual engagement of stakeholders, negative impacts can be minimised or eradicated and positive impacts can be maximised. Ensuring that all stakeholders and affected groups have been identified and consulted has therefore been the emphasis of the consultation process for the Dibamba Power Project, with opportunities to obtain a wide range of views and to ensure a widespread understanding of the project.

4.4.3 Method

As discussed above, public participation in environmental decision-making is an important element of the Environmental and Social Impact Assessment (ESIA) process. In line with

Section 4: Scoping and Consultation

this, consultation has been an integral and on-going part of the ESIA process for the Dibamba Power Project. This commenced in September 2007, with informal consultation taking place during the initial scoping visit by the Scott Wilson ESIA Team accompanied by a team of surveyors from Safex, and continued during subsequent visits in November 2007. Ongoing consultation has continued throughout the preparation of the ESIA report and will continue throughout the project life from initial construction, through operation to decommissioning. Consultation of a range of stakeholders has been conducted both formally and informally.

Stakeholder Identification

Involving the right stakeholders during appropriate stages of the consultation process has been a key concern of the project ESIA process. This has been achieved using appropriate stakeholder identification techniques. Stakeholder identification is undertaken to determine who will be directly or indirectly affected, positively or negatively, by a project (commonly called project affected people or project-affected groups), and who can contribute to or hinder its success (commonly called other relevant stakeholders). It is important for the project sponsor to be comprehensive in identifying and prioritizing all project stakeholders, including the disadvantaged and voiceless. Those identified will then need to be consulted to varying degrees, depending on level of impact, at strategic points during the life of the project.

It should be noted that stakeholder identification and involvement are often context-specific, i.e. what works with one project may not be appropriate for another (IFC, Doing Better Business Through Effective Public Consultation and Disclosure: A Good Practice Manual, 1998). With these principles in mind the project used the following methods for stakeholder identification:

- Formal and informal public consultation meetings;
- Document and literature review;
- Household surveys; and
- Informal unscheduled discussions.

By using the above approaches, the project was able to gauge the views of a wide range of people. A list of those consulted can be found in Table 4.4.1.

Formal Public Consultation

Objectives of Formal Public Consultation

The main objectives of the formal public consultation undertaken with the ESIA process have been to:

- Formally introduce the project to key stakeholders;
- Adhere to the public consultation requirements of Cameroon legislation and the IFC (see Section 2); and

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- Hear stakeholder issues and concerns and to try to address them, as appropriate with provision of information in the meetings and through the ESIA report.

The project team sought the advice of local and national government during the ESIA scoping phase of the project. Initial introductory meetings were therefore held in September 2007 with the Ministry of the Environment and Nature Protection and the Divisional Officer of Douala III and relevant Ministries to discuss the project, available information and to obtain advice on the best approach to consulting with project affected people. As a result, it was agreed with government and AES Sonel to have a public meeting with the Divisional Chief of Douala and a public meeting with the community in the affected village, Yassa, in November 2007 as set out in Table 4.4.1. This protocol ensured that the main chief of the area was briefed first and therefore was involved at the initial stages of the formal consultation process and was an integral part of the process.

In line with Cameroon legal requirements, the public consultation meeting in Yassa Village was organised a month in advance. The date was agreed with the Divisional Officer and AES Sonel.

Meetings with Douala Divisional Chief

Divisional chiefs are the most senior members of the traditional local political structure and are often responsible for several villages. An invitation was sent out to the Divisional Chief, responsible for the project area (i.e. districts of Douala III), one month in advance of the meeting.

A formal consultation meeting was held, with the Divisional Officer, the Chief, and AES Sonel. During this meeting the Chief was informed about the project and the consultation process, and was requested to inform the villagers of the November consultation and the proposed household survey.

Public Meetings

The public consultation meeting was conducted in Yassa, (see Table 4.4.1) which will be affected by the project. As discussed above, the Chief was requested to inform his respective villages of the public meeting.

The objectives of this meeting were to explain the project to local people including the compensation process, and to provide an opportunity for local people to raise their concerns about the project.

A local divisional government officer, as well as a member of AES Sonel, Scott Wilson and Safex attended the meeting.

The meeting was conducted in French. The generic structure of the meetings was as follows:

- Introduction and explanation of meeting by Divisional officer;
- Presentation by AES Sonel of project description;

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- Presentation by Scott Wilson and Safex on the process of the ESIA and IFC/World Bank guidelines on compensation; and
- Questions and answers.

Attendance at the village meeting was approximately 150 people. Copies of the lists of attendees and minutes are presented in Appendix G of this report.

Informal Consultation

Informal consultation and meetings with various stakeholders have been an ongoing activity in the project. Members of the ESIA team have had informal discussions with local affected communities, health centre staff and local government officials between September and December 2007. The household survey, which was carried out in November 2007, provided a further opportunity for discussions with villagers about their issues of concern.

Timing

AES Sonel commenced consultation during discussions with government authorities regarding the need for new power sector development in Cameroon, the purchase of the land and obtaining of the Public Utility Decree. AES Sonel held meetings with The World Bank's energy sector (Environment, Engineering and Infrastructure departments).

During the third site visit by the ESIA team in November 2007, a formal consultation meeting was held. The meeting with the paramount chief of Dibamba was also conducted in November 2007. The meeting with the affected village was carried on the 27th November 2007. Additionally, prior to the village meeting a week was spent completing household surveys and a week observing the Land Commission survey. The sample household survey also included informal consultation with a number of stakeholders. A full list of people met and dates can be found in Table 4.4.1.

Consultation will be on-going through the project and, in line with both Cameroonian legislation and IFC/World Bank guidance, a further stage of formal consultation will be undertaken once the draft ESIA report is complete and made available for review as discussed in Section 8. This next meeting is referred to as a Public Audience.

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Table 4.4.1: Summary of Stakeholders Consulted up to December 2007		
Date	Stakeholder and Affected Groups	Purpose of Consultation
<i>Ministries and Government Agencies</i>		
19th September 2007	General Secretary of the Mayor of Douala III	To introduce the project and investigate potential stakeholders, any concerns with the project and to collect data on Douala III.
19th September 2007	Douala III Sub Divisional Officer	To introduce the project and Scott Wilson and to discuss the most appropriate approach for carrying out public consultation with villagers and key community leaders. To obtain permission to undertake baseline environmental and household surveys in and around the project area and Yassa village.
20th September 2007	Ministry of Environment and Nature Protection	To introduce project and Scott Wilson to the Ministry, to discuss the public consultation requirements, and to gather baseline data.
20th September 2007	Ministry of Agriculture and Rural Development	To introduce project and Scott Wilson to the Ministry, to discuss any concerns the ministry may have and to gather baseline data.
20th September 2007	Ministry of Energy and Water	To introduce project and Scott Wilson to the Ministry, to discuss any concerns the ministry may have and to gather baseline data.
20th September 2007	Ministry of Forestry and Wildlife	To introduce project and Scott Wilson to the Ministry, to discuss any concerns the ministry may have and to gather baseline data.
21st September 2007	Ministry of Public Works	To introduce project and Scott Wilson to the Ministry, to discuss any concerns the ministry may have and to gather baseline data.
21st September 2007	Ministry of Transport	To introduce project and Scott Wilson to the Ministry, to discuss any concerns the ministry may have and to gather baseline data.
21st September 2007	Urban Council Waste Officer	To introduce project and Scott Wilson to the Ministry, to discuss any concerns the ministry may have and to gather baseline data.
21st September 2007	Ministry of Territorial Planning and Development	To introduce project and Scott Wilson to the Ministry, to discuss any concerns the ministry may have and to gather baseline data.
<i>Yassa – Community</i>		
16th-23rd November 2007	Informal discussions with villagers during the household surveys, household surveys and focus groups	To introduce the project and informally gather any concerns. More details can be found in section 6.
27th November 2007	Public consultation at the Chief of Yassa Villages house	To introduce the project to local leaders and to inform them about the consultation process and to request them to inform the affected villages about the forthcoming village consultations.
<i>Other</i>		
17th September 2007	IFC and AfDB	To introduce the Scott Wilson team and gather any concerns the funding bodies may have/specific areas that they would like to be looked at.

Several attempts have been made by AES Sonel to contact the adjacent soap factory, all of which have so far been unsuccessful.

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4.4.4 Key Results of Consultation Process

From the feedback obtained at the village meeting there appears to be a general endorsement of the project, but with some key caveats. These caveats relate to better consultation; fair compensation; increased access to electricity and preferential employment. These issues are summarised in Table 4.4.2 and discussed in detail in Sections 6.3 and 6.5.

Some of the concerns that have been raised are a result of the experience of past projects and are not necessarily a result of the AES Sonel project process. However, villagers do seem to be distrustful of large corporations and some local officials. The importance of good consultation cannot, therefore, be overstressed.

Table 4.4.2: Key Issues Raised at Public Consultation meeting 27th November 2007

Area of Concern	Issue	Response¹	ESIA²
Electricity	Electricity provision. It was felt that villages or individuals that did not have power before the project should as part of the project. People felt that electricity should be provided for free or heavily subsidised.	AES Sonel said it would look into it, as a country wide electrification program is underway	6.5
Potable Water:	Potable water provision. The majority of villages do not have accessible potable water. Communities would like provision of potable water as part of their community compensation package.	This is outside the remit of the ESIA.	
Employment	People requested that local populations be given sufficient and relevant training opportunities to enable them to compete for project jobs. They also requested that they be given priority during the AES Sonel recruitment process.	AES Sonel said it would do all it can to ensure local people are able to be involved in the project.	6.4
Compensation and Resettlement	<p>Compensation requested for damage done during preliminary works of the project in October 2005.</p> <p>Compensation for fallow land where the soils has been destroyed as a result of clearing for the transmission line.</p> <p>Will lands without legal title get compensation?</p> <p>Compensation for land as well as any structures built on it.</p> <p>Will the loss of any property other than land get compensation?</p> <p>Concerns that resettlement and compensation will be delayed or incomplete by the lack of participation/communication from the local community</p> <p>Concern that crops and medicinal plants will not grow within 100km of the power line/plant.</p> <p>Concerns as to whether there will be compensation in the event that property is stolen during the resettlement and compensation process.</p>	AES Sonel will carry out a fair compensation programme in accordance with WB OP 4.12.	6.3

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Table 4.4.2: Key Issues Raised at Public Consultation meeting 27th November 2007

Area of Concern	Issue	Response ¹	ESIA ²
Community Relations and Consultation	<p>Poor information dissemination. Communities wanted assurance that consultation would be carried properly and that they would receive written explanation about the project.</p> <p>Maps and project documents explaining where the transmission line will run were requested.</p> <p>What is the land area to be taken for the project?.</p> <p>The concerns of the civil community should be taken into account when when impact mitigation measures are proposed.</p>	<p>AES Sonel is committed to a transparent consultation process.</p> <p>Consultation will be carried out with respect to the environmental decree</p>	4.4
Community Development	<p>Village project committee to liaise with AES Sonel requested.</p> <p>Concern that as the Yassa population's main sources of income/food are their crops, potential ecosystem pollution would lead to significant health and economic impacts.</p>	<p>Local mayors and chiefs and village representatives are already involved in the project process.</p>	4.4
Health	<p>Concern about the effects of possible radiation from the transmission lines on human health.</p> <p>Concern about potential health impacts due to pollution affecting crops.</p> <p>Concerns on toxic fuel emissions and health effects such as pulmonary infections.</p>	<p>All the correct safety checks will be carried out</p>	6.6
Environment	<p>Concerns on toxic fuel emissions.</p> <p>Where/how is fuel going to be stored?</p> <p>Concerns on environmental impacts deriving from fuel storage and transport and leakages with consequent soil/groundwater pollution.</p> <p>Where will fuel be stored/disposed of?</p> <p>What will be the impact of heavy fuel on mangroves?</p> <p>What atmospheric emissions will the project incur? Impacts on air quality?</p> <p>What will happen to fuels following their use?</p> <p>Why was heavy fuel chosen instead of e.g. gas? (given heavy fuel combustion's environmental impacts)</p> <p>What will be positive and negative environmental impacts of the project be?</p>		
Cultural Property	<p>Medicinal and Sacred Trees: There was a concern about what would happen to these properties in the plant site and the along the transmission line.</p>	<p>The project will try to avoid sacred forests and trees with medicinal value.</p> <p>If destroyed, a fair compensation will be provided</p>	6.3

¹Response from AES Sonel

²Section within ESIA, which deals with this issue

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4.4.5 Conclusion

Generally, the consultation process has been well received by the affected community. However, in order to maintain this goodwill, there is a need to distribute non-technical project summaries and maps to the affected people. Furthermore plans need to be made for the required public audience in conformity with article 13(1) of the Decree no 2005/0577/PM. This will entail the distribution of the executive summary of the ESIA report in English and French (if required) in public reading rooms throughout the project area.

The IFC's 'Doing Better Business Through Effective Public Consultation and Disclosure: A Good Practice Manual' (IFC, 1998), provides action oriented guidelines aimed at ensuring that consultation with the affected population and with officials of local government, civil society organisations and other representatives of the affected population is both effective and meaningful. The guidelines emphasise the need for the project sponsor to ensure that the process of public consultation is accessible to all potentially affected parties, from national to local level. Emphasis is placed on the engagement of local stakeholders, namely people who are likely to experience the day-to-day impacts of a proposed project. On a practical level, the sponsor has to ensure that:

- All stakeholders have access to project information;
- The information provided can be understood;
- The locations for consultation are accessible to all who want to attend;
- Measures are put in place, which ensure that vulnerable or minority groups are consulted; and
- Managing distrust with consultation.

In addition to these IFC guidelines, the project should be particularly sensitive to some of the feelings of mistrust amongst local community. This will involve choosing a village representative carefully and constantly reviewing the consultation strategy. One approach could be to rotate the village representative so that there is a good representation of people, including women and those of a lower economic status. These types of measures will help to mitigate the perception that it is only those with power who will be consulted and therefore compensated.

Section 5

Environmental Impact Assessment

SECTION 5 : ENVIRONMENTAL IMPACT ASSESSMENT

5.1 INTRODUCTION

The following section of the report has been based on the outcome of the Terms of Reference (see Appendix E) for the Dibamba Power Project and presents the results of the EIA for the project on a subject basis as follows:

- Air Quality;
- Noise and Vibration;
- Transport;
- Water Resources;
- Landscape and Visual;
- Land Use;
- Ecology;
- Cultural Heritage;
- Geology and Soils; and
- Waste.

5.2 EIA METHODOLOGY

The overall approach to the EIA is set out in Section 1.

The terms of reference for the EIA established the environmental impacts considered to be potentially significant and therefore requiring detailed assessment. As such, the specific methodology for the EIA has been developed to ensure sufficient baseline data has been available in order to assess the potential environmental implications of the proposed project.

Wherever possible, existing secondary data has been utilised to provide an understanding of the existing baseline conditions. However, where this has been considered to be insufficient, specific primary data collection has been undertaken. This has included, in particular, the undertaking of ecological field surveys, air quality monitoring and noise monitoring during 2007. Details of the baseline data and specific field surveys undertaken are presented on a discipline-by-discipline basis in Sections 5.3 to 5.12 respectively.

The load profile for the power station is shown in Table 3.3.3, with the plant operating at full load (88MW) during the period of peak demand (1700 to 2300hrs) in the dry season (January to June), when production from the hydroelectric plant is limited due to low water flows. The assessment of impacts of the proposed plant have therefore been undertaken on a worst-case basis, with the plant assumed to be operating on heavy fuel oil at continuous 100% output.

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5.3 AIR QUALITY

This section discusses the current and future ambient air quality in the area around the plant site and transmission line corridor. The potential effects on air quality are considered in relation to World Bank ambient air quality guidelines as outlined in the New Thermal Power Plant Pollution Prevention and Abatement Handbook 1998.

A qualitative assessment has been made of the potential impacts of fugitive releases of dust around the proposed plant site and transmission line route during the construction phase of the project. Operational emissions from the power plant stacks have been modelled to evaluate the proposed stack height and determine the magnitude of the change in air quality statistics for Nitrogen Dioxide (NO₂), Sulphur Dioxide (SO₂) and fine particulate matter (PM₁₀) in the area around the proposed plant.

5.3.1 Baseline Conditions

There is one existing industrial development in the vicinity of the proposed power plant, the Savonnerie Azur soap factory (here in known as the 'soap factory'), which is adjacent to the site directly to the north. The other main local sources of combustion emissions are the nearby Douala to Edéa main road and domestic emissions from local housing. Traffic travelling along the main road is light, averaging approximately 3,500 vehicles per day. Such road traffic flows would be likely to make a moderate contribution to baseline pollutant concentrations. Domestic emissions are unlikely to be significant due to there being only scattered residences in the vicinity (see Figure 5.3.1).

The transmission line follows the route of the main road and will join with the existing high voltage transmission line at Yassa Junction, approximately 1.8km to the west. The route passes through an area that is predominantly rural in character.

Cameroon does not have an established network of air quality monitoring stations in the project, or wider, area. In order to evaluate the baseline air quality in the vicinity of the proposed site, a 3-month diffusion tube survey commenced during November 2007. The survey included the measurement of NO₂ and SO₂ at ten locations within a short distance of the power plant site. At three sites, diffusion tubes have also been deployed to determine local background concentrations of ozone (O₃). A member of the Scott Wilson ESIA team visited Cameroon in November 2007 to set out the monitoring and to train a member of staff from Safex (the local partner) on how to set up the monitoring and chose a good location.

Monitoring sites (see Figure 5.3.1) were chosen in order to evaluate the contribution to baseline pollutant concentrations from the soap factory and local road traffic, and also to establish background levels in areas remote from significant sources of combustion emissions. Once the results of the baseline monitoring survey become available (March 2008), it is intended to incorporate them within this assessment and produce an updated ESIA Chapter.

In the absence of local background data, this assessment has initially used data gathered during a similar monitoring exercise to determine baseline air quality at two sites adjacent to a proposed power plant site at Kribi, approximately 120km to the south. This location can be considered to be typical of rural Cameroon. Monitoring took place between April and June 2006. The results of the study are detailed in Table 5.3.1.

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Pollutant	Average ($\mu\text{g}/\text{m}^3$)
NO ₂	1.0
SO ₂	1.5
O ₃	39.0

Note: This table will be updated with the results of the monitoring survey, when data becomes available

For evaluation purposes these concentrations are compared to the World Bank guideline values, as set out in Table 5.3.2.

	Reference Period	Recommended maximum ground level concentration values ($\mu\text{g}/\text{m}^3$)
NO ₂	24 hour average	150
	Annual average	100
SO ₂	24 hour average	150
	Annual average	80
Total Suspended Particulate	24 hour average	230
	Annual average	80
PM ₁₀	24 hour average	150
	Annual average	50

The World Health Organisation (WHO) have also published air quality guidelines, these are listed in Table 5.3.3. The limits are broadly similar to EU Limit Values and are not mandatory. The WHO guideline values have been set at a level that provides protection of human health for all members of the public.

	Reference Period	Recommended maximum ground level concentration values ($\mu\text{g}/\text{m}^3$)
NO ₂	1-hour average	200
	Annual average	40
SO ₂	10-minute average	500
	24-hour average	125
	Annual average	50

Background concentrations (Table 5.3.1) of NO₂ and SO₂ are far below both World Bank and WHO guideline values, reflecting the very low level of current emissions of these

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pollutants typical of rural areas in Cameroon, including the area around the proposed site. Background levels of ozone are typical of equatorial latitudes. The photochemistry of the region is limited by low levels of NO₂ and as a result minor emissions of nitric oxide would be rapidly converted to nitrogen dioxide. However, more significant emissions of nitric oxide would be converted into nitrogen dioxide as the plume disperses downwind. Measured concentrations of oxides of nitrogen would be composed of nitric oxide and nitrogen dioxide in varying proportions at any given distance from the source.

Overall, baseline air quality in the vicinity of the proposed plant site and transmission line corridor can be considered to be good.

5.3.2 Potential Impacts

Potential significant air quality impacts from the proposed development relate primarily to point source gaseous emissions from the power plant stacks during operations. However, short-term local impacts may also arise from fugitive dust and gaseous emissions from plant and vehicles during the construction phase.

The main potential impacts include:

Construction

- *Exhaust fumes* from construction traffic and plant at the plant site and along the transmission line route; and
- *Dust generation* from construction activity and trafficking of construction vehicles across unsurfaced roads and cleared sites areas.

Operation

- *Power Plant Emissions* from power generation plant stacks arising from the burning of the main fuel source, Heavy Fuel Oil (HFO). The plant would also burn Light Fuel Oil (LFO) as a start-up fuel.

Exhaust fumes

Construction

The anticipated volumes of construction traffic and plant activity would represent an increase over current traffic movements on the main road running past the site. However, overall traffic flows are relatively low (see Section 5.5). Therefore the impact of additional vehicle emissions during the construction phase on air quality, taking into account the low levels of baseline air pollution, will not be significant. This impact is not therefore assessed further within the ESIA.

Operation

Traffic volumes during the operational phase will be very low and therefore no significant air quality impacts will arise from this source.

Dust Generation

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Construction

The primary potential air quality impacts arising from the construction phase is dust generated from construction activities and the movement of construction vehicles on unsurfaced areas.

Site preparation, construction works and the movement of site vehicles can generate dust emissions. Dust is particulate matter in the size range 1-75micrometres (μm) in diameter, and is produced through the action of abrasive forces on materials. Fine particulate matter (PM_{10}) is defined as particles less than $10\mu\text{m}$ in diameter, and is of the most concern regarding health effects. Construction dust is generally larger in diameter than $10\mu\text{m}$ and, therefore, does not necessarily increase existing levels of PM_{10} considerably. Particles between 10 and $75\mu\text{m}$ in diameter are not typically associated with adverse effects on human health, their main potential effects being the soiling of surfaces. (Soiling is the cumulative deposition of airborne particles on to a surface). This can affect sensitive receptors, such as residences and crops.

During the construction of the power plant and transmission line, some activities would have potential to generate emissions of fugitive dust. These include:

- Vehicle movements on unsurfaced areas;
- Land clearance to remove vegetation from construction areas and excavation;
- Land levelling and grading of the site and access road route;
- The storage on site of surplus excavation materials and dusty building materials;
- Construction of site buildings and installation of plant and equipment; and
- Clearance of the wayleave and access tracks, plus excavation for and placement of concrete pads along the transmission line route.

In the wet season it is likely that the regular and intense rainfall typical of the area would significantly reduce the frequency and severity of impacts from dust generated by the works, by maintaining a high level of moisture within exposed soils and by washing deposited material from surfaces.

At the present time, there are no statutory World Bank or EU standards relating to either ambient concentrations of airborne dust or to rates of surface soiling by dust particles. In the absence of agreed standards for construction dust levels the control of construction dust should be managed by the adoption of best practices on site. However, even where mitigation measures are employed some dust is likely to disperse off-site and has the potential to impact local residents.

Operation

There will be minimal maintenance activities during the operational phase but there is the potential to generate fugitive dust at the plant and during wayleave maintenance. There would be no significant air quality impacts arising from this source. However, this impact is not therefore assessed further within the ESIA.

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Power Plant Emissions

This is purely an operational impact, as the power plant will not be functioning during the construction phase.

The main air quality impact during the operation of the proposed power plant will be emissions to air from the combustion of fuel within the power plant engines. The primary fuel for the plant will be Heavy Fuel Oil (HFO). Light Fuel Oil (LFO) will be burned during the plant start-up procedure.

Emissions to air from the burning of HFO and LFO will include carbon dioxide (CO₂), oxides of nitrogen (NO_x), SO₂, and particulate matter, a proportion of which will be PM₁₀. The particulate matter emitted to atmosphere may include small quantities of trace metals.

There are currently no national limits for emissions from power plants in Cameroon. Therefore emission guidelines for the new thermal power plants burning fossil fuels, as detailed in the World Bank Pollution Prevention and Abatement Handbook (1998), are employed in the design of the plant. The appropriate emission standards relating to engine-driven power plants of less than 50MW are detailed in Table 5.3.4.

Table 5.3.4: World Bank Emission Guidelines for New Thermal Power Plants		
	Emission Guideline (mg/Nm³)	
Fuel	LFO	HFO
Particulate Matter	50	50
SO₂	0.2 metric tonnes/day/mw or 2000mg/Nm ³	0.2 metric tonnes/day/mw or 2000mg/Nm ³
NO_x	2000	2000

Reference conditions: 15% O₂, dry.

An assessment of the potential impacts has been undertaken through an air quality modelling exercise. This assessment is based on a power plant configuration consisting of eight Wartsila 18V38A2 reciprocating engines. Discharge to atmosphere from the plant occurs via eight stacks, grouped into two clusters, one stack for each engine. The location of the power plant stacks is illustrated in Figure 3.3.1, and listed in Table 5.3.5.

Table 5.3.5: List of Stack Locations					
Stack Number	X Coordinate	Y Coordinate	Stack Number	X Coordinate	Y Coordinate
1	924701	1441603	5	924735	1441597
2	924704	1441602	6	924738	1441596
3	924702	1441605	7	924735	1441600
4	924705	1441605	8	924738	1441599

Note: The x and y coordinates listed are specific to the modelled grid and do not relate directly to national or international co-ordinate systems.

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Model Scenarios

The power plant is intended to operate during situations when additional capacity is required and it is not expected that the station will operate at continuous load throughout the day or year. No continuous base load scenario has therefore been considered within the assessment.

The output from the proposed power plant would be higher during the evening hours, when there is a greater demand for electricity. At other times of the day, the plant would run at a much lower load, with as little as one power unit (engine) operating between the hours of 2300 and 1700 during the wet season. During the dry season, when production from hydropower stations is limited due to low water regulated flows, the proposed power plant is expected to run at full load between the hours of 1700 and 2300. The variation of emissions from the power plant have therefore been modelled according to the load profile set out in Table 5.3.6. An engine has been assumed to be running at 100% load whenever it is operating.

Table 5.3.6: Power Station Load Profile		
Months	Number of Units Operating at 100% load	
	1700 - 2300	2300 - 1700
January – June (Dry Season)	8	2
July – December (Wet Season)	4	1

A summary of the emissions modelled from each engine (when operational) is provided in Table 5.3.7.

Table 5.3.7: Engine Emission Data (18V38)		
Scenario	100% load, HFO	Notes
Stack Internal Diameter (m)	1.2	
Exit Velocity (m/s)	25.8	Calculated, based on supplied volumetric flow rates (actual).
Stack Exit Temperature (K)	620	
CO emission rate (g/s) ¹	2.7	-
NO _x emission rate (g/s) ¹	44.0	Calculated as NO ₂
SO ₂ emission rate (g/s) ¹	24.0	
PM ₁₀ emission rate (g/s) ¹	1.1	As total dry particulate dust, assumed to be PM ₁₀

¹ Emission rates are per engine stack; there are 8 stacks in total.

The effect of stack height on ground level concentrations of the pollutants emitted has been evaluated as part of the sensitivity analysis, by running AERMOD with stack heights of 30, 35, 40 (standard), 45 and 50metres. Annual mean ground level concentrations are compared with the air quality guidelines in Tables 5.3.2 and 5.3.3.

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The air quality impacts on the surrounding area resulting from the operation of the proposed plant, as calculated by the dispersion model (see Appendix H), are combined with existing ambient air quality statistics and compared with the assessment criteria to evaluate the potential significance of effects.

Hazardous Air Pollutant (HAP) Emissions

The emission of unburned hydrocarbons and NO_x may contribute to the formation of ground level O₃. Reactive plume modelling would be required to assess the impact of these pollutants in forming O₃. No such modelling has been performed as part of this assessment, as there is limited potential for the proposed plant to significantly effect local or regional ground level O₃ concentrations.

Carbon Dioxide (CO₂) Emissions

An estimate of annual CO₂ emissions from the proposed power plant has been made, based on projected fuel consumption data. The plant would burn approximately 40,000Mt HFO and 2,000Mt LFO per annum. Annual CO₂ emissions have been calculated using the Intergovernmental Panel on Climate Change (IPCC) Tier 1 estimation methodology. The CO₂ emissions calculation is outlined in Table 5.3.8.

Table 5.3.8: Annual Power Station CO₂ Emissions			
Fuel	HFO	LFO	Notes
Annual consumption (t)	40,000	2,000	Data from AES Sonel
Net Calorific Value (TJ/10 ³ t)	40.19	43.33	IPCC Value
TJ Output	1607.60	86.66	
Kilowatt hour (KWh) Output	4.47 E+08	2.41 E+07	
Carbon Emission Factor, CEF (t C/TJ)	21.1	20.2	IPCC Value
Carbon Emissions per Annum (t)	33920	1751	
Carbon Emissions per Annum, as CO ₂ (t)	124,375	6,419	
Total CO₂ Emissions per Annum (t)	130,793		
gCO₂/kWh	278.5	266.6	

Predicted Operational Impacts

For each pollutant, it is evident that the maximum impact would occur to the North East of the proposed plant and that impacts to the west of the site are lower in magnitude. The largest emissions for a locally important pollutant are those of oxides of nitrogen and these disperse to raise predicted annual mean concentrations of nitrogen dioxide by between 0.8µg/m³ and 35.7µg/m³ above baseline levels. This represents a range of 1% - 36% of the World Bank criteria of 100µg/m³.

Emissions of SO₂ are predicted raise annual mean concentrations by between 0.4µg/m³ and 31.7µg/m³ above baseline levels. This represents a range of 0.5% - 40% of the World Bank criteria of 80µg/m³.

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The predicted impacts on annual mean levels of PM₁₀ achieve the World Bank criteria by a very large margin.

The magnitude of short term impacts have also been predicted at selected receptors located close to the power plant. Maximum 24-hour impacts in the range of 2.8 – 44.2µg/m³ for NO₂ were predicted. This represents a range of 2% - 30% of the World Bank criteria of 150µg/m³. Maximum 24-hour impacts for SO₂ are predicted to range between 1.5 and 59.1µg/m³. This represents a range of between 0.5% and 40% of the 150µg/m³ World Bank criteria.

With a proposed stack height of 40m, the WHO hourly standard value for NO₂ and 10-minute standard for SO₂ would only be achievable at a limited number of receptors under specific meteorological conditions. The World Bank and WHO guidelines are not directly equivalent and although the predicted emissions would not fully achieve the WHO guidelines, the corresponding World Bank criteria would be met in full.

5.3.3 Mitigation Measures

Dust Generation

Fugitive emissions of dust during the construction phase would be minimised and controlled by the implementation of an Environmental Management Plan for the project (see Section 7). Mitigation measures to reduce construction dust emissions could include:

- Wherever possible, materials arising from site earthworks will be stored and used within the site. This will reduce the number of off-site vehicle movements required;
- Site roads and the site access route will be inspected, swept and sprayed with water as required to prevent dust causing a nuisance off site. An appropriate site speed limit, e.g. 10kph, will reduce dust generation from vehicles travelling over unmade surfaces;
- No mitigation measures will be required to control emissions from on site vehicles beyond accepted good practice. For example, maintaining vehicles in good working order, parking vehicles away from sensitive receptors and not running engines for longer than is necessary;
- All plant and stockpiles will be thoughtfully located, so as to minimise impacts on sensitive receptors. Where practicable to do so, storage areas should be located at least 50m from sensitive receptors. Surplus excavation materials from the transmission line route will be moved if necessary to designated areas, away from sensitive receptors;
- The unnecessary handling of dusty materials will be avoided. During the processing of dusty materials, methods to mitigate the generation of dust emissions will be employed, such as minimising drop heights and dampening materials and surfaces with water;

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- The area cleared for construction activities will be kept to a minimum, retaining ground cover where possible, including a screen of vegetation and mature trees between the power plant site and the main road and residential housing;
- Completed earthworks will be landscaped and vegetated or covered with hard standing as soon as practicable; and
- A record will be kept of complaints received and actions taken.

Power Plant Emissions

No specific measures are employed to limit stack emissions. However, stack height will be specified to minimise impacts at ground level.

5.3.4 Evaluation of Mitigated Impact

Dust Generation

Construction

The potential magnitude of dust impacts without mitigation is not considered within this assessment, as standard mitigation techniques for the control of dust emissions, including those identified in Section 5.3.3 above, will be included in the EMP for the project.

Construction dust can only have a significant impact on sensitive receptors if they are located in fairly close proximity to the activity. The potential for dust to be transferred off site, to affect PM₁₀ levels or cause a perceptible increase in soiling rates, is likely to be limited to around 100m from construction, which involves earthworks.

There is a distance of approximately 200m between the nearest residential properties (sensitive receptors) and the power station site boundary. As such, the impact of dust emissions due to construction activities occurring on the power plant site would be unlikely to be significant.

The incorporation of effective site management procedures and mitigation measures to control dust would ensure that the impact of construction works on nearby sensitive receptors would be minimised. Residual episodes of enhanced dust deposition should be restricted to periods of unusually dry and windy weather, during which background levels of dust would also become elevated.

The construction of the transmission line would occur over a short time period (8 months). Dust impacts at residential properties would be short term and minor, however there are no such properties nearby.

A small proportion of the dust generated by construction activities will be PM₁₀. Under normal meteorological conditions, receptors located more than 50m from the emission source are unlikely to experience a perceptible increase in PM₁₀ concentrations. It is therefore unlikely that a measurable change in PM₁₀ concentrations will be observed during the construction of the power plant. The impact of PM₁₀ emissions on sensitive receptors during the construction of the site access road and the transmission line would be adverse, short term in nature and would be of minor significance.

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Power Plant Emissions

The principal control on operational emissions from the plant is in the form of stacks, of sufficient height to facilitate adequate dispersion of the exhaust plume before the pollutants reach ground level. The assessment has been based on the assumption that all eight stacks would be 40m high and it has been confirmed that stacks of this height provide a level of protection at local air quality sensitive receptors sufficient to achieve World Bank criteria.

Overall the impact from the operation of the plant on air quality is therefore assessed as adverse, long term, and minor significance.

5.3.5 Evaluation of Alternative Development Options

The zero (no project) option would remove the potentially negative impacts that may arise from the construction and operation of the project.

No further alternatives have been considered within this ESIA with regards to impact on air quality.

5.3.6 Conclusions

The overall conclusion from this assessment is that the construction and operation of the Dibamba Power Plant would result in an effect on air quality that was minor adverse significance, in the worst case. During the construction phase dust generation would have a low potential to cause short-term dust impacts at the nearest residential properties. Simple and effective control measures for containing dust generation are available.

During normal operation, the engine emissions result in ground level pollutant concentrations below the World Bank guideline values. Modelling indicates that the maximum ground level concentration will be experienced to the north-east of the site due to local meteorological conditions.

A summary of the impact evaluation is presented in Table 5.3.9.

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Table 5.3.9: Summary of Impact Evaluation – Air Quality

Project Location	Phase²	Impact	Nature of Impact	Receptor	Nature¹	Duration¹	Significance¹
Plant site	C	Dust nuisance / heath risk	Dust rise from on site activity	Local population	Adverse	Short-term	Insignificant
	C	Reduced local air quality	Vehicle exhaust emissions	Local population	Adverse	Short-term	Insignificant
	O	Reduced local air quality	Emissions from power plant	Local population	Adverse	Long-term	Minor
Transmission line	C	Dust nuisance / heath risk	Dust rise from on site activity	Local population	Adverse	Short-term	Minor
	C	Reduced local air quality	Vehicle exhaust emissions	Local population	Adverse	Short-term	Insignificant
1 – see Table 1.5.1 for definition 2 – Phase - C = Construction / O = Operation / D = Decommissioning.							

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5.4 NOISE

5.4.1 Introduction

This section assesses the potential noise impact of both construction and operation of the proposed power plant site and the associated transmission line, considering World Bank and IFC guidance.

The assessment benefits from an ambient noise survey, undertaken in September 2007, which characterises the existing noise climate in the area surrounding the plant site.

Considering the lack of existing and proposed sources of vibration, and in particular the distances to the closest receptor locations, the assessment of vibration impacts has been scoped out.

A summary of noise perception and terminology used within this assessment is provided in Appendix I.

5.4.2 Baseline Conditions

To characterise the existing noise climate in the area, a baseline noise survey was conducted in 2007. Measurements were taken at two locations (see Figure 5.3.1), using type 1 integrating sound level meters:

- Brüel and Kjær 2238. Microphone: Brüel and Kjær 4188, serial 2555536; and
- Brüel and Kjær 2238. Microphone: Brüel and Kjær 4188, serial 2555151.

Calibration certificates for all noise equipment are available upon request.

A 'Kestrel 1000' hand-held anemometer was employed to verify wind speeds whilst on site.

Calibration levels were checked before and after each monitoring period with a Brüel and Kjær 4231 field calibrator. No changes (>0.1 decibels (dB)) in the calibration level were noted. Instrumentation was programmed to log free field noise levels (i.e. with the microphones at a minimum 1.5m above ground level and not within 3m of any other reflective surface), over 5-minute contiguous periods.

As the proposed power plant may run continuously throughout the day and night for part of the operational year, measurements were taken for periods of at least 24 hours.

The two monitoring locations were selected to represent the closest sensitive properties to the proposed development. Location X, situated to the north west of the proposed site is considered representative of three residential dwellings in this area. Monitoring was undertaken for approximately 46 hours between the 2007. Location Y was situated further to the west of the proposed site, adjacent to another larger residential dwelling. Monitoring was undertaken at Location Y for approximately 24 hours.

Results of the noise monitoring are provided in Table 5.4.1.

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Monitoring Location	Day (0700 – 2300)			Night (2300 – 0700)		
	L _{Aeq} (dB)	L _{A90T} Typical Range (dB)	L _{A90} mode (dB)	L _{Aeq} (dB)	L _{A90T} Typical Range (dB)	L _{A90} mode (dB)
X	65	40 to 62	55	64	55 to 59	57
Y	58	37 to 58	55	57*	48 to 56*	54*

*includes periods of rain

Monitoring results show little variation between day and night periods. The baseline monitoring survey indicates an average daytime L_{Aeq}¹ of 65dB at Location X, and an average nighttime L_{Aeq}² of 64dB. At Location Y, the average daytime L_{Aeq} was measured as 58dB and the nighttime as 57dB.

During the daytime period, the dominant noise sources at Location X included traffic on the nearby road, noise produced by the existing soap factory, insect noise and occasional aircraft. At Location Y, neither road traffic noise from the main road, nor noise from the existing soap factory was audible. The dominant noise source noted whilst at this location was insect noise. This resulted in a more steady noise level at this location, illustrated by the reduced difference in measured L_{Aeq} and L_{A90} noise levels.

Time histories of the baseline noise monitoring are provided in Appendix I

5.4.3 Potential Impacts

Noise impacts from the proposed development may arise from the necessary construction activities and from the power plant during the operational phase. The primary noise generating activities are summarised as:

- On-site noise generation both from construction activities and the operation of the main power plant;
- Traffic noise from delivering materials to the transmission line and plant area construction sites and operational transportation of fuel; and
- ‘Corona discharge’ during wet conditions from the high voltage transmission lines.

Site Activity

Construction

Construction activity will be ongoing at the plant site for approximately 15 months. Four general phases are anticipated: site preparation; civil works; electro / piping installation; and tank / building erection.

¹ WHO definition of daytime is 0700 to 2300 and use L_{Aeq} values

² WHO definition of nighttime 2300 to 0700

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Following consultation with Wärtsilä, a list of plant associated with each construction phase has been compiled and attributed a noise level based on reference documents and recognised standards from the UK. This information has enabled predictions of noise at the selected receptors to be undertaken, representing worst-case 1-hr periods within daytime periods.

Construction activities associated with the installation of the transmission lines include excavation works and the preparation of concrete foundations. Construction progress is expected to be at a rate of approximately one tower per day.

Operational Noise

The primary noise generating activity during operation of the site will be from the engine sets, associated ventilation and cooling plant, air intake and exhaust gas emissions.

Using reference noise data provided by the contractors and operational data provided by AES Sonel (Table 5.3.6), resultant noise levels at receptor locations have been predicted, and assessed in terms of significance against International Standards and existing measured noise levels.

Traffic Noise

Construction

A number of vehicle movements relating to the importation of materials, plant and labour have been associated with each phase. These have been quantified within the ESIA Transport Section 5.5 and have been included in the construction noise predictive calculations.

Minimal vehicle movements are expected per day related to the erection of the transmission line and the resultant noise impact is considered negligible.

Operational

Daily traffic movements associated with the operational phase will relate to importation of fuel to the power plant and movement of staff and guards to and from the site. However, trip generation is considered very low and the resultant noise impact will be negligible.

Corona Discharge

Noise from overhead power lines can be produced by a phenomenon known as 'corona discharge'. Consisting of broadband noise (hiss, crackle, etc.), it is generally only audible under particular meteorological conditions e.g. during rainfall, and is caused by ionisation of the air surrounding the conductor. Overhead lines are built to minimise this, but surface irregularities caused by damage, and / or raindrops may locally enhance the electric field strength sufficient for corona discharges to occur.

As ambient noise levels at all potential receptor locations increase during periods of rainfall, the relative noise impact of this phenomenon is considered to be insignificant, and is not assessed further within the ESIA.

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5.4.4 Assessment Method and Criteria

Noise levels generated by the construction and operation of a development, that are experienced by local receptors, depend upon a number of variables, the most significant of which are:

- The noise generated by plant or equipment used on site, road traffic and other sources, generally expressed as sound power levels (L_{WA});
- The periods of operation of the plant on the site, known as “on-time”;
- The distance between the noise source and the receptor;
- The attenuation due to ground absorption, air absorption and barrier effects; and
- In some instances, the reflection of noise due to the presence of hard surfaces such as the sides of buildings.

Standard acoustical formulae have been employed to consider the above variables and predict resultant noise levels at the selected (closest) receptor locations. Receptor locations are as follows:

Receptor A = Monitoring Location X

Receptor B = Monitoring Location Y

Receptor C = Soap factory

Criteria

World Bank (WB) and International Finance Corporation (IFC) guidelines, with regard to environmental noise, quote that noise levels as a result of a development should not exceed the levels presented in the World Health Organisation publication of 1999: ‘Guidelines for Community Noise’. With regard to residential properties, these guidelines are as follows:

- Environmental daytime and evening (external) limits of 55dB L_{Aeq} over the 16-hour daytime period (0700-2300); and
- For night time noise sources the WHO guidelines recommend a night-time (2300-0700) 8-hour noise level of 45dB L_{Aeq} (external).

This guidance has been used to assess potential noise impact of the proposed development, both in terms of the construction and operational scenarios. Reference will also be given to the measured noise levels at locations representing the nearest residential dwellings to the site.

With regard to industrial / commercial receptors (e.g. the soap factory adjacent to the site), the WHO recommends a 24hr guideline limit of 70dB L_{Aeq} .

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5.4.5 Construction Noise Predictions

Predictions of $L_{Aeq,1hr}$ values at each of the selected receptor locations, as a result of construction activities, have been undertaken using standard acoustical formulae.

Assumptions, including those relating to construction phases and associated plant, are provided in Appendix I.

Results of the predictions are provided in Table 5.4.2.

Table 5.4.2: Power Station Construction Noise Predictions			
Phase	Receptor A	Receptor B	Receptor C
	$L_{Aeq, 1hr}$ (dB)		
Site Preparation	56	35	64
Civil Works	47	32	61
Electo / piping installation	48	33	62
Tank (and building erection)	45	26	55

The highest predicted noise levels at the residential receptors are primarily due to the number of HGV movements anticipated during the site preparation phase, and the relative proximity of the site access route to Receptor A.

Construction Noise Impact Assessment

Predicted noise levels as a result of construction activities (Table 5.4.3) relate favourably to the WHO guideline of 55dB L_{Aeq} . It is only during the site preparation phase when worst-case levels are predicted to marginally exceed this guideline level.

Predicted noise levels at Receptor C (the soap factory) are higher as it is closer to the site. However, it is noted that noise levels are not predicted to exceed the WHO guideline value of 70dB L_{Aeq} .

While some noise impact is an unavoidable consequence of construction work, the erection of the transmission line is transitory in nature and as such the impacts will only be incidental on any given receptor for a relatively short time period.

Based on the understanding that no piling works are proposed, it is considered that vibration levels as a result of all construction activities will be negligible.

It is understood that construction works will occur during daytime periods only.

Considering the worst-case nature of the predictions, the temporary nature of construction works, and the existing measured level of 65dB L_{Aeq} at the nearest residential receptor, the impact as a result of construction activities is considered to be short term and negligible.

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5.4.6 Operational Noise Predictions

Predictions of worst-case $L_{Aeq, 1hr}$ values at each of the selected receptor locations, as a result of operational activities, have been undertaken using standard acoustical formulae.

All assumptions and considerations employed within the predictive calculations, including those relating to the source data, are provided in Appendix I.

Results of the predictions are provided in Table 5.4.3.

Table 5.4.3: Power Station Operational Noise Predictions			
Number of operational engines*	Receptor A	Receptor B	Receptor C
	$L_{Aeq, 1hr}$ (dB)		
8	60	50	76
4	57	47	73
2	54	44	70
1	51	41	67

*Ref Appendix I

The results in Table 5.4.3 show that (with eight engines operating) predicted noise levels exceed WHO guideline values for residential properties for daytime and nighttime at Receptor A, for night time at Receptor B, and at industrial / commercial receptors (Receptor C).

Operational Noise Impact Assessment

The predicted levels within Table 5.4.3 are based on varying numbers of generator sets (and associated plant operating. It is understood that the worst-case scenario i.e. eight engines operating simultaneously, may only occur during the dry season (January to June) between 1700 and 2300. A level of 60dB L_{Aeq} is predicted at the closest receptor location under this scenario. This is 5dB in excess of the WHO guideline value.

For the remainder of the daytime and the nighttime periods during the dry season, only 2 engines may be operating. This would result in the predicted noise levels at all receptor locations reducing by 6dB (A). Consequently, noise levels at all three receptor locations will be within WHO recommended guidelines for daytime, and noise levels at Receptor B would be below nighttime guideline values. Only at Receptor A would nighttime noise levels exceed the guideline value of 45dB L_{Aeq} .

During the rainy season (July to December), it is understood up to four engines may operate between the hours of 1700 and 2300. For the remainder of the daytime period and the nighttime period during the rainy season, only one engine will operate. With four engines operating (daytime), all WHO guidelines are adhered to with the exception of Receptor A where predicted levels marginally exceed 55dB $L_{Aeq, 1hr}$.

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Comparison of the predicted L_{Aeq} values with the measured ambient L_{Aeq} values at Receptors A and B indicates that neither during the daytime nor the night time do predicted noise levels exceed the baseline.

Therefore, despite exceeding WHO guideline values under certain circumstances, and at certain receptor locations, it is considered that operational noise will not be significant.

5.4.7 Consideration of cumulative effects

A soap factory currently contributes to the existing background noise levels and has therefore been accounted for in the monitored baseline noise measurements. This factory is expected to remain in place following the introduction of the power station.

The cumulative impact has been defined as the increase in noise level at receptor locations when the predicted power plant noise and the existing measured baseline noise are combined:

$$65\text{dB } L_{Aeq} \text{ (day measurement at loc A)} + 60\text{dB } L_{Aeq} \text{ (predicted)} = 66\text{dB } L_{Aeq}$$

$$64\text{dB } L_{Aeq} \text{ (night measurement at loc A)} + 60\text{dB } L_{Aeq} \text{ (predicted)} = 65\text{dB } L_{Aeq}$$

The resulting increase of +1dB L_{Aeq} is considered negligible.

5.4.8 Mitigation Measures

Construction phase

No specific mitigation measures are considered necessary during construction of the power plant or transmission line. However, the following good practice measures, which are also mentioned in the EMP, will assist in reducing noise levels as far as is practicable:

- Regular maintenance of all plant and equipment;
- Not allowing engines to run unnecessarily;
- Undertake cutting, grinding, and other such operations within an enclosure during the day;
- Controlling loading and offloading of materials (especially steel work);
- Locating noisy operations at the maximum distance from noise sensitive receptors;
- Briefing staff on appropriate techniques and methods; and
- Controlling and limiting traffic movements around the sites.

Operational phase

Noise mitigation measures already assumed and incorporated into the predictive calculations include:

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- Exhaust gas silencer;
- Charge air silencer; and
- Power House walls (in terms of sound reducing properties of the façade cladding).

Other mitigation measures that are currently being considered include:

- Construction of an earth bund on the northern edge of the site; and
- Stepping of the site through the site levelling process.

Mitigation afforded by the above measures is quantified within Appendix I.

In addition, all doors to the power house are assumed to be closed when engines are operating.

No further specific mitigation measures are considered necessary other than plant be regularly maintained, engines only operate with all power house doors closed, and that all noise mitigation measures assumed in the predictions are in place.

5.4.9 Decommissioning

Potential noise disturbance during the decommissioning phase is likely to be less than that of the construction phase. Therefore, the assessment of construction noise is considered to represent the worst case for decommissioning. Once decommissioning is complete, noise impact from the installation will be removed.

5.4.10 Evaluation of Alternative Development Options

The zero (no project) option would remove the potentially negative impacts that may arise from the construction and operation of the project. However, no significant impacts have been identified.

5.4.11 Conclusions

Baseline noise monitoring has been undertaken at selected locations around the site in order to classify the existing ambient noise climate in the area.

Predictions of noise levels at receptor locations have been undertaken as a result of both construction and operation of the proposed power station. These predictions have been compared against International Standards and the measured data in order to assess any potential noise impact.

Predicted noise levels as a result of construction activities are expected to exceed WHO daytime criteria. However, this is only marginal, based on anticipated worst case conditions, and levels are likely to be below the existing ambient measured levels. Significance of construction noise is therefore considered negligible.

Predicted levels as a result of certain operational circumstances of the power station exceed WHO recommended guidelines at the closest receptor location. However, comparison with the existing measured levels indicates that current levels in this location

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exceed both the WHO guidelines and operational predictions. Given the predicted cumulative impact with the neighbouring soap factory resulting in an increase of 1dB, the impact of operational noise is considered negligible.

Table 5.4.4: Summary of Impact Evaluation – Noise							
Project Location	Phase²	Impact	Nature of Impact	Receptor	Nature¹	Duration¹	Significance¹
Plant site	C	Increased noise levels	Construction activity	Local residents and soap factory	Adverse	Short-term	Minor
	O	Increased noise levels	Turbine operation	Local residents and soap factory	Adverse	Long-term	Minor
Transmission line	C	Increased noise levels	Construction activity	Local residents	Adverse	Short-term	Minor
	O	Increased noise levels	Corona discharge	Local residents	Adverse	Long-term	Insignificant
1 – See Table 1.5.1 for definition 2 – Phase - C = Construction / O = Operation / D = Decommissioning.							

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5.5 TRANSPORT

5.5.1 Baseline Conditions

The Road Network

Road transport constitutes the main mode of transportation of goods and persons in Cameroon. It handles 90% of passengers and nearly 75% of freight transportation (ADF, 2006).

The total length of the road network in Cameroon is estimated at 50,000km. The road network of Cameroon has been classified since 1979 on the basis of Decree No. 79/093 of 12th March 1979 that defines the functions of the national, provincial and divisional classified roads, as well as rural roads. As reported by the African Development Fund (ADF) in 2006, the national inter-city road network is divided into four categories, namely:

- (i) National roads (7,241km) that essentially link the provincial capitals to the national capital, Yaoundé, and the neighbouring cities;
- (ii) Provincial roads (5,841km) that link divisional chief towns within the province to the provincial capital;
- (iii) Divisional Roads (8,075km) that link within a division, the district to the chief town of the division; and
- (iv) Rural roads which have an estimated length of 27,693km including 12,843km under the classified network. They serve the rural areas, plantations, local industrial areas and provide a link between the production zones, local markets and major marketing routes.

The state of roads in Cameroon, established during the formulation of the Government's Buildings and Civil Works Strategy in 2005, is given in the Table 5.5.1. This shows that the majority of the country's infrastructure is generally of a poor condition.

Table 5.5.1: Road conditions in Cameroon					
Type of Infrastructure	Quantity	Proportion	State of Network		
			Good or Normal	Mediocre	Poor
Roads					
Paved	5000km	10%	26%	26%	48%
Earth (PN and NPN)	18000km	38%	11%	80%	9%
Rural Earth (PN and NPN)	27000km	52%	14%	10%	76%
Structures					
Civil Engineering Structures	1196	98%	26%	28%	46%
Ferries	29	2%	28%	31%	41%

Source: Adapted from ADF, 2006

The strategic situation of Cameroon makes it a transit zone for much of the sub-regions and this has led to the Government to design in 1994, with the support of donors, a Transport Sector Project (TSP) whose aim continues to be focused not only on the improvement of the highway network but on the opening up of the hinterland to facilitate market penetration.

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Site Location

The proposed Dibamaba Power Project site is located off the main RN3 Douala-Edéa trunk road, approximately 20km east of Douala. The RN3 is part of the main route from the major port at Douala to the capital Yaoundé where it connects with 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 carrying a large number of HGV movements.

The section of the RN3 road where the site is located is constructed to a high standard with the road at a minimum width of 7m with hard verges up to 1m wide. Surfaces are in good condition with very few potholes or ruts (see Photo 5.5.1).

Local Access

The site is located some 300m from the RN3 along an existing rural earth road (see Photo 5.5.2). Some residential properties are situated adjacent to this track near the main road.

Visibility at the point where it meets the RN3 is good in both directions and there was some evidence in the area that vegetation clearance of highway verges was commonplace (see Photo 5.5.3 and Photo 5.5.4).

Transport Routes

The main transport routes associated with the carriage of people and goods to/from the proposed site during construction and operation will primarily involve the RN3 road between Dibamba-Douala and between Douala-Limbe.

The first section will cater for the movements of construction workers and plant from Douala, including heavy machinery arriving at Douala Port. In tandem with the first section, the RN3 Douala-Limbe road will be used for the transport of fuel from the Sonara processing plant at Limbe during the power plant's periods of operation. However, it could also be used for transporting sand from the Mungo River, should the material found in the Dibamba River prove to be unsuitable for construction.

In total, the entire length of the Limbe-Dibamba route stretches some 100km. It straddles two different administrative areas, with the Limbe-Mungo segment being in the South-West Province and the Mungo-Douala-Dibamba segment falling under the governance of the Littoral Province.

The route is characterised by a number of distinctive environments with different types of road widths, surface conditions and levels of frontage activity. These attributes can affect the ability of vehicles to travel along the various segments identified and this impedance can be expressed in terms of capacity (i.e. congestion), speeds, driving styles required and decision indicators such as routing, travel times and other restrictions.

The different characteristics of the route give a good indicator of the aspects to be taken into account when considering a Transport Management Plan (TMP). In terms of this baseline assessment, the road conditions are described below and shown diagrammatically in Figure 5.5.1 and Figure 5.5.2 for the Douala-Dibamaba and Douala-Limbe sections, respectively.

The route from the site at Dibamba to the urban fringes of Douala is a single carriageway for much of its length and is generally graded to avoid any steep inclines (see Photo 5.5.5).

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Outside the main town, the route is through open countryside with occasional villages and ribbon development at main road intersections, such as around the neighbouring village of Yassa, which acts as the main focal point for retail and community activities in the area around the project site (see Photo 5.5.6).

On the outskirts of Douala, the route passes a market area named 'Axe-Lourd Village' with dense frontages of workshops, market stalls, petrol stations, hotels, etc, set-back from the road (see Photo 5.5.7). The main carriageway is paved and in good condition but through traffic finds itself restricted by the high number of vehicles turning or dropping people off (e.g. taxis and moto-course scooters). This is predominantly in the morning and evenings where, in some places, two-lane traffic develops in both directions to overcome the problem caused by secondary activity and slowing vehicles. At other times of the day, normal operation resumes with some limited overtaking of larger vehicles (see Photo 5.5.8).

The route from Axe-Lourd Village to Douala is paved and of a dual carriageway configuration with a number of grade-separated junctions which contributes to relatively free-flowing traffic. A number of underpasses, including a runway of Douala Airport cross over the road, although no indication of height restriction could be seen (see Photo 5.5.9). At this location, the movement of opposing traffic is separated by a central reservation which changes from kerbed strip to metal barrier and eventually a drainage channel at the approach to the centre of Douala (see Photo 5.5.10).

The centre of Douala comprises a dense highway network, with both single and dual-carriageway roads. The Port of Douala is located to the west of the town centre and connects with the strategic road network at two locations along the Quai de la Marine; to the north with the Carrefour de la Marine and to the south with the Axe Lourd Douala-Yaoundé road. Figure 5.5.4 shows the general network arrangement of the town, which will be discussed from the perspective of routing in Section 5.5.5.

A single-carriageway bridge provides the main connection with areas located beyond the Wouri River to the west of Douala, including the main road to Limbe. It is understood that a number of reinforcement works have recently been completed to the main structure of the bridge and that preparatory works are planned for converting the eastern overland section of the bridge into an road embankment. As the only entry/exit from the west, the approach along the bridge to Douala involves some queuing during the morning and evening peaks (see Photo 5.5.11).

The immediate area to the west of the Wouri River is characterised by a high concentration of light industry and small-scale manufacturing, including automotive repair and furniture-makers. However, the subsequent market area of Bonaberi is most noticeable for its potholes and high water run-off. For approximately 3km, the road is deformed and degraded in several areas due to the combined effects of the traffic and rains. Vehicular speeds are very low and the road conditions leads to poor lane discipline, although good signalling was in evidence (see Photo 5.5.12).

At the western end of Bonaberi, a large number of travel agencies and buses provide connections with the areas to the North of Cameroon, including Bamenda and Bafoussam. Beyond this, the amount of road frontage diminishes, the road surface is good and traffic levels are relatively low (see Photo 5.5.13). At Bekoko, a grade-separated interchange divides the RN3 road into the RN3 to Limbe and the N5 to Nkongsamba and Bamenda.

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The single-carriageway road from Bekoko to Limbe is paved and in excellent condition with detailed lane-markings, including overtaking advisory solid white lines, speed restrictor signs and signs indicating any narrow sections. A number of black figurines are also present to indicate the location of previous fatal accidents and therefore the more hazardous areas. Near the village of Ayatto, a bridge has been recently constructed over the Mungo River to replace one which had failed and this has been accompanied by new side protection, revised speed limits of 40kph and road humps (see Photo 5.5.14). This location also marks the separation between the Littoral and South-West Provinces.

At the village of Bonakoh, there is a toll gate collecting money for the maintenance of the road (see Photo 5.5.15). Indeed, over recent years, it has been Cameroon's intention to improve the recovery of infrastructure costs through tolls and road user fees (ADF, 2006).

The single-carriageway road continues through palm and banana plantations for approximately 6km. At Tiko Town, activity and frontage reduces the effective speeds of vehicles, although the single-carriageway road is slightly wider at this location. To the west of Tiko Town, a sharp incline is met by the presence of a crawler lane making it 2-lanes westbound for approximately 2km. At the top of the hill, the commercial centre of Moutengene Village is announced by dense retail frontages and lower traffic speeds. There is also the first example along the route of ghost island left-turns on the Main market street.

The single-carriageway road from Moutengene to Limbe continues for some 25km through a number of palm and banana plantations, the Ombe Industrial Zone and the village of Mille Four. Two-three storey buildings are in evidence upon entering the outskirts of Limbe, where a number of hotels are present. The Sonara petroleum plant is situated next to AES Sonel's Limbe Power Plant and access to both facilities is provided by way of separate ghost island junctions (see Photo 5.5.16).

5.5.2 Transport Data Sources

Wider Area Traffic Counts

The ADF (2006) suggests that, in 2005, the average annual daily traffic (AADT) on any one road in the entire road network of Cameroon was between 70 and 5,000 vehicles/day with the highest traffic being found near Yaoundé and Douala and on paved roads. On the paved sections of the Trans-African Highway, traffic is about 1,400 vehicles/day on the Bafoussam-Yaoundé Road, and reaching 2,700 vehicles on the Douala-Yaoundé road.

Baseline data for traffic flows on the main carriageway next to the proposed project site have been collated from published data. On the Douala-Edéa road, published data was obtained from the Ministry of Public Works, Department of Programming report on the campaign for traffic counting (November 2005).

The available count on the Douala-Edéa road, presented in Table 5.5.2 below, was conducted at a location approximately 20 km outside Douala which would be in the vicinity of the project site. With little opportunities for abstraction, this is a reliable estimate of the levels of traffic outside the project site.

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Year	Car	Pick Up	Mini Bus	Bus	Small Lorry	Medium Lorry	Articulated Lorry	Timber Lorry	Total
1999	1613	654	647	201	390	327	405	266	4503
2000	1620	657	648	205	391	330	406	271	4528
2001	1705	662	651	277	407	35	411	272	4720
2002	1363	291	549	111	186	127	311	64	3003
2003	1673	366	644	125	233	169	421	57	3689
One week data (daily average traffic) for 2005									
2005	1704	322	521	139	195	204	509	69	3664
2007 ¹	1427	311	471	271	181	223	316	66	3346

¹ Average from July 2007 count

The data above show that overall traffic volumes on this road are moderately high by Cameroonian standards with between 3,000 to 4,500 vehicle movements per day. Approximately 20% of the traffic consists of medium or heavy lorries and over 25% consists of small lorries, buses and mini buses. The data also suggests that the volumes of traffic have reduced in recent years, with no apparent transfer to larger vehicles (e.g. minibus to coaches or small to larger lorries).

Additional traffic information was obtained following a meeting with the Littoral Provincial Officer of the Ministry of Public Works on 21 September 2007. The data are shown in Table 5.5.3 and Table 5.5.4 for the Douala-Edéa and the Douala-Nkongsamba sections, respectively.

Date	Car	Pick Up	Mini Bus	Bus	Small Lorry	Medium Lorry	Articulated Lorry	Timber Lorry	Total
09-Jul	1552	477	531	232	136	168	324	55	3497
10-Jul	1186	264	556	368	173	220	273	65	3105
11-Jul	-	-	-	-	-	-	-	-	-
12-Jul	1367	284	422	272	209	229	319	56	3158
13-Jul	1282	328	411	199	231	260	374	49	3134
14-Jul	1510	182	440	254	71	115	167	88	3456
15-Jul	1816	366	450	251	254	343	459	91	3940

Date	Car	Pick Up	Mini Bus	Bus	Small Lorry	Medium Lorry	Articulated Lorry	Timber Lorry	Total
09-Jul	1760	334	822	25	152	78	239	2	3395
10-Jul	1722	326	648	19	132	76	265	0	3171
11-Jul	-	-	-	-	-	-	-	-	-

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Date	Car	Pick Up	Mini Bus	Bus	Small Lorry	Medium Lorry	Articulated Lorry	Timber Lorry	Total
12-Jul	1645	295	586	26	133	69	213	1	2968
13-Jul	2550	432	805	31	147	104	246	2	4317
14-Jul	3055	122	381	21	44	34	112	0	4401
15-Jul	2647	268	859	30	40	44	135	0	4023

For the Douala-Edéa section, the levels of traffic recorded in 2007 are consistent with the recent historical data shown in Table 5.5.2. There is little flow variability between individual weekdays but increased levels of movements on Sunday. This in contrast to the Douala-Nkongsamba section, where traffic flows fluctuate between 3,000-4,500 vehicles and levels peak on Saturday. What is common to both sets of data, however, is the large reduction in commercial and public transport vehicle movements on Saturday.

The Douala-Nkongsamba count was described as being taken at the Bekoko Interchange, which is located at a point of confluence for the RN3 and RN5 roads. In the context of the typical maximum daily flows reported in Cameroon, the level of traffic recorded would suggest that this includes traffic bound for both Limbe and Bamenda, although this has not been confirmed.

As a reference point for the likely traffic levels between the Bekoko Interchange and Limbe, observed count data collected by Black and Veatch in 2003, as part of the ESIA for the construction of the Limbe Power Plant, has been summarised in Table 5.5.5. From East to West, this section of route was surveyed along the following segments; Bekoko to Tiko Town, Tiko Town to Mutengene, Mutengene to AES Sonel substation and AES Sonel substation to Sonara refinery.

Day	Period	Dir	From-To	Cycles	M'cycle	Car	Vans	Bus	HGVs	Total
Weekday										
Mon	1030-1130	WB	Bekoko-Tiko	0	5	300	6	1	4	316
	1030-1130	EB	Tiko-Bekoko	1	2	78	25	24	6	136
Wed	1700-1800	WB	Tiko-Mutengene	2	15	322	23	23	0	385
	1700-1800	EB	Mutengene-Tiko	4	10	330	32	32	3	411
Fri	0730-0830	WB	Mutengene- Substation	6	2	274	38	12	0	332
	0730-0830	EB	Substation-Mutengene	2	1	148	43	12	0	206
Fri	1030-1130	WB	Substation-Sonara	0	1	177	4	13	0	195
	1030-1130	EB	Sonara- Substation	2	0	193	11	4	0	210
Weekend										
Sat	1600-1700	WB	Bekoko-Tiko	1	3	130	21	18	2	175
	1600-1700	EB	Tiko-Bekoko	1	6	95	16	17	5	140
Sun	1000-1100	WB	Tiko-Mutengene	0	8	245	18	9	0	280

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Day	Period	Dir	From-To	Cycles	M'cycle	Car	Vans	Bus	HGVs	Total
	1000-1100	EB	Mutengene-Tiko	0	3	207	18	0	0	228
Sun	1000-1100	WB	Mutengene-Substation	1	10	116	0	1	2	130
	1000-1100	EB	Substation-Mutengene	0	0	90	2	15	6	113
Sun	1000-1100	WB	Substation-Sonara	2	1	332	0	3	0	338
	1000-1100	EB	Sonara-Substation	0	2	137	1	5	1	146

The counts undertaken in 2003 were conducted on various days and cover different time periods. It is therefore not possible to make any generalisation concerning the data set as a whole but it can be seen from the surveys that the traffic flow level on the Bekoko-Limbe segment of the route range between 400 and 800 hourly movements on weekdays and 250-500 at the weekends. These levels seem relatively high in the context of the expected daily profile in Cameroon.

Local Access

The access to the site currently consists of an earth road. It is proposed that this road be made-up for approximately 800m of its length in order to connect the site with the RN3 Douala-Edéa Road. In determining the type of junction that would be required, traffic counts were conducted by Safex (the local partner after training had been undertaken) at the project site on Thursday 20 September 2007, as shown in Table 5.5.6. These were conducted both in the morning and evening, by direction and using the same governmental classification outlined in Table 5.5.3 and Table 5.5.4.

Time Period	Dir	Car	Pick Up	Mini Bus	Bus	Small Lorry	Medium Lorry	Articulated Lorry	Timber Lorry	Total
0700-0800	EB	63	26	14	17	8	15	24	16	183
	WB	27	7	10	5	6	8	9	20	92
	Total	90	33	24	22	14	23	33	36	275
0800-0900	EB	73	19	13	16	1	6	12	4	144
	WB	36	6	7	5	1	7	3	7	72
	Total	109	25	20	21	2	13	15	11	216
1700-1800	EB	54	7	13	8	6	10	12	1	111
	WB	106	17	10	6	10	8	16	1	174
	Total	160	24	23	14	16	18	28	2	285

The results of the selective count indicates that hourly morning and evening movements are between 216 and 275 vehicles. This is against a typical link capacity for a single carriageway of between 1200-1500 vehicles per hour. As such, the traffic flows on the road adjacent to the proposed site access are below the capacity thresholds at which congestion is likely to occur.

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The distribution of traffic between eastbound (EB) and westbound (WB) directions, shown in Table 5.5.7, suggests that the main direction of the flow is away from Douala in the morning and towards the town in the evening. This suggests that the traffic at this location is strategic in nature and under the influence of larger attractors situated further away, such as Yaoundé. It is likely, therefore, that Douala would be the main attractor affecting the distribution of traffic closer to town, such as in Axe-Lourd Village, for example.

Time Period	Eastbound	Westbound
0700	67%	33%
0800	67%	33%
1700	39%	61%

5.5.3 Identification of Transport Effects

Traffic impacts can arise during all phases of the project although the greatest impacts will be during the construction phase. Principal impacts that can arise are:

- Disruption to transport links through delays and congestion brought about by increased traffic movements;
- Conflict with road users;
- Localised disruption as a consequence of the construction of the new road;
- Increased perception of traffic associated with increases in HGV movements; and
- Road safety implications associated with increases in traffic.

Each of these impacts is directly related to the volume of traffic generated by the proposed development. An assessment of this traffic has been made with reference to the transportation of materials and labour to the project site.

Construction

Details of traffic that will be generated during the construction phase have yet to be developed and will be largely informed by the Mobilisation Plan which will be prepared by the contractor. This plan will be accompanied by a series of methods statements for all major construction activities that will be submitted to AES Sonel for approval. It is the intention that these statements will adhere to the mitigation measures set-out in the ESIA, which have been based on a general understanding of the movements involved.

During the construction phase most operations will be undertaken in sequence although some will be continuous for most of the construction period. Key sequential phases are:

- Initial site clearance and land grading – traffic to bring staff to site and delivery of machinery;

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- Access road, foundations and hard standing and building construction – import of materials (sand, gravel, cement, etc.) and labour (peak activity);
- Installation of main plant and equipment – importation and haulage of equipment from the port at Douala;
- Commissioning of plant – limited technical staff traffic to site; and
- Construction of transmission line – importation of steel works, sand, gravel and cement to site along the wayleave area.

The primary means of access to the project site will be along the existing earth road. It is currently not proposed that other local roads be used during construction, with the exception of the transmission line, the construction of which may necessitate a limited number of movements, although it is anticipated that the work sites will move along the wayleave area as sections are complete.

Equipment and Materials

The greatest traffic generation will be during the main construction of the access road, foundations, etc. as this will require the greatest importation of materials and labour. Estimated peak lorry movements for importation of materials during this phase will be in the order of 20 movements per day.

During the main construction works at the plant site, the plant equipment will be imported. A total of some 200 lorry loads will be generated during this phase but this will be spread over the 15 month construction and installation period. Estimated peak movements for this phase are 10 to 20 loads per day.

For the transmission line, each tower site will involve approximately 10 lorry loads of materials with completion of approximately one tower per day. Prior to erection of the tower, foundations will be excavated and concrete foundations laid. Foundations are small and therefore this will result in only a few vehicle movements per day.

For the construction phase, peak traffic movements will therefore be during the placement of the foundations and initial building works at the plant site, with overall traffic movement reducing during the installation and commissioning phase. Along the transmission line, traffic movement will be more constant over the 8 month construction period but overall movements will be significantly less than at the plant site.

It is currently understood that cement and reinforcement steel can be purchased in Douala, there is an aggregate quarry within the vicinity of Douala, earthing cables are manufactured locally and that timber sewerage pipes are locally available. Equipment procured outside of Cameroon will be delivered by ship to the Port of Douala. These materials and equipment will be transported by road to the site.

A number of movements would occur within the site and along the wayleave area of the transmission line. Consultation with the contractor, Wärtsilä, has led to the summary of required equipment, shown in Section 3.3.

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Labour Force

The power plant contractor, Wärtsilä, has indicated that average manpower will be 270 persons and that the peak at any one time could be in the region of 480 persons. The contractor is likely, and will be encouraged by AES Sonel, to use local sub-contractors and local labour for civil works and transportation.

It is understood that the necessary manpower is available locally and that the opportunities for laying on dedicated workbuses during the period of construction will feature prominently in the Mobilisation Plan which will be prepared by the contractor. Assuming an average occupancy of 20 workers per bus, it is therefore anticipated that, at the peak, a total of 48 daily two-way movements would be generated.

Operation

During the operational phase, no major delivery of staff or materials to the site will be required, with the exception of the occasional delivery of maintenance equipment and materials.

The power plant will be fired on fuel delivered to the site by tankers. It is estimated that, during the operation of the plant, its requirements for fuel would be translated into approximately 12 tanker movements per day. These tankers would originate from the Sonara refinery located in Limbe and would travel via Douala in order to reach the plant at Dibamba.

In addition, there will be a requirement for the transportation of staff and guards to and from the plant. This will be at the beginning and end of each 8-hour shift with an estimated total of 40 staff to be transported each 24-hours. For comparison, the AES Sonel power plant at Limbe has an operating workforce of around 35 persons operating three shifts between 0700-1400, 1400-2100 and 2100-0700 and therefore all movements occur outside the peak hours.

There will be no regular traffic movements associated with the transmission line during the operational phase, with only occasional inspection taking place along the wayleave area.

Traffic generation associated with the operational phase of the site is very low and will not have any significant impacts. The operational phase will not therefore be assessed further within this ESIA.

Decommissioning

The level of traffic generation created during the decommissioning phase will be totally dependent on the final decision on the use of the plant site and buildings. This cannot be assessed at this stage. However, it is most unlikely that overall traffic volumes would be greater than for the construction phase. As such the assessment of impacts for construction will represent the worst case for decommissioning.

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5.5.4 Potential Impacts

Increased road movements

During the construction phase, a number of vehicle movements will take place along the Douala-Edéa road. At the peak working phase, total traffic movements generated by the development are likely to be in the order of 30 to 40 movements per day for material and labour.

The transportation of materials from local suppliers is likely to involve movements from Douala along the Douala-Edéa road. Other imported goods will arrive at the Port of Douala with subsequent road transit. In addition, it is likely that the transportation of sand for use in construction will originate from the Mungo River, located to the west of Douala, thereby necessitating a transit through the town in order to arrive at the Dibamba project site.

It is estimated that 50% of the traffic will comprise large vehicles associated with the transportation of materials. As such, it is estimated that not more than 15-20 heavy vehicle movements would be generated daily. In the context of the current traffic information for the Douala-Edéa road, this represents an increase in the order of 0.9-1.2% in total traffic or approximately 1.9%-2.6% increase in large vehicle movements, at equivalent 2007 levels.

There are no known Cameroonian standards or World Bank guidelines with respect to assessing the significance of changes in traffic flow on road networks. Corresponding UK guidance for the assessment of the environmental effects of traffic is provided in the Institute of Environmental Assessment (IEA), Guidelines for the Environmental Assessment of Road Traffic (1993).

The IEA document indicates that highway links subject to traffic flow increase in magnitude of less than 30% result in no discernable change in conditions. An increase of 10%, however, can be considered material where there are local sensitive receptors, which is expressed as affecting 100 (Low), 200 (Medium) and 300+ (high) properties. In the immediate vicinity of the project site there are few residences, the closest residence to the plant site is 200m and three properties will be directly affected along the wayleave.

Road safety

Increase in traffic volumes on any section of road has the potential to increase the risk of accidents with potential injury to other road users and pedestrians.

The degree of risk is related to the level of increase in the volume of traffic and the nature of the highway network being used. For the most part, the transport route for the project, described in Section 5.5.1, uses Cameroon's strategic highway network and consequently the most suitable type of road for the movements of goods and people.

Particular areas of risk are at road junctions and within urban areas with high local traffic and pedestrian use. In the context of this study, the transport routes do traverse a number of populated areas, including the centre of Douala as well as a number of smaller villages.

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Design of the access road

The proposed scheme would see the re-surfacing of the access road for approximately 800m along the same alignment and this will also involve the creation of a formalised priority junction off the RN3 Douala-Edéa Road. Care must be taken to ensure that the design of this new intersection does not compromise the capacity of the main carriageway and it meets the relevant standards in design (e.g. safety, visibility) and construction (e.g. specification, methods).

5.5.5 Mitigation Measures

Increased road congestion

Given the road network and the nature of the development, there are mitigation options to address the potential problem of increased congestion. Proposed mitigation is as follows:

- *Route Management* – The formulation of a strategy which ensures that interference with existing road users is as low as practicable by addressing the following topics:
 - *Selection of route* – There is only one route from Douala to Dibamba and this cannot be altered. A number of routes, however, exist in Douala and the most appropriate route has been selected for HGV movements. This is shown in Figure 5.5.3.
 - *Route sensitisation* – The route from Limbe to Dibamba traverses a number of sensitive locations such as villages and other built-up areas. Based on the baseline assessment undertaken, Figure 5.5.1 and Figure 5.5.2 those areas where driving style and effective speed should be adjusted to take account of local conditions.
 - *Hours of operation* – Managing the hours of operation to minimise movements during peak traffic periods. Restrictions can be imposed on night-time deliveries to minimise disturbance to residents. The TMP should address these restrictions in terms of more sensitive locations.
- *Reduction in traffic movements* – Limited options exist as the construction requires set quantities of materials and labour delivered to site. However, bus transport for workers will be provided to maximise numbers of persons per trip and lorry loads delivering to site will be maximised, i.e. full loads only where practical, to reduce overall movements.
- *Planned convoys* - Special convoys will be used for the movement of sensitive or heavy machinery. Low loaders will be used where possible and transport of these items will avoid peak periods of traffic to minimise congestion. It is likely that convoys would only be required between the Port of Douala and the project site, subject to the necessary structural considerations. Convoys are not proposed for the Limbe-Douala section, as the ESIA for the Limbe Power Plant (2003) identified that 2 out of the 14 bridges between Douala and Limbe cannot take the load.
- *Directional Arrangements* – Marshalling of vehicles and suitable storage areas may be required to minimise any queuing of traffic along the access road which could result in blocking-back onto the main carriageway.

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Increased accident and safety risks

Increased risk to road users is related to the increase in volume of traffic and the route the haulage takes. As noted above, limited options exist for altering either of these. Therefore the main mitigation measures to be implemented to reduce accident risk are as follows:

- *Driver Training* – Education for drivers to increase awareness of sensitive areas, identified in the Route Management plans. In addition, sub-contractors will be required to assess the competence of each driver and brief them on the following:
 - Daily vehicle checks
 - Tyre Changing
 - Understanding vehicles' operating limits
 - Vehicle Care (revving engine, safe breaking)
 - What to do in the case of an accident
 - Reporting Defects
 - Securing Loads
- *Health and Safety* – Implement appropriate driver safety procedures including limiting hours of working, ensuring no alcohol or other substances are consumed prior to or during shifts. An information board with site safety information will be displayed on-site, including contact details of first-aiders on-site;
- *Vehicle Maintenance* – Vehicles will be maintained to ensure breaks, lights and warning signals are fully functioning;
- *Signage Strategy* – Signage to be erected on the main road leading up to the site access and to provide advanced warning to site traffic and other motorists. A prescribed speed limit will also be in force on the access road. Road markings will be in accordance with relevant Cameroon standards;
- *Consultation* – Presentation to local villagers to inform them of the increased traffic and duration of works. Consideration should also be given to undertaking an educational presentation at local schools to reinforce the messages of traffic awareness and site safety; and
- *Emergency Response* – A plan will be developed addressing all eventualities including, for example, fire, explosion, collapse of structure, serious injuries, spillage of chemicals and exposure to toxic substances.

Design of the access road

Junction performance tests have been carried out to ascertain the maximum hourly number of vehicle movements that can be accommodated off a single point of access, without increasing the delay to vehicles travelling on the main carriageway. The PICADY software was used to test the surveyed 2007 flows shown in Table 5.5.6, assuming a main carriageway width of 7m and an access road width of 6m, being the minimum practicable width to accommodate HGVs.

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The results of the PICADY analysis indicates that, based on the surveyed 2007 count information, the relationship between site traffic and main carriageway flow can be expressed in terms of a maximum 160 hourly vehicular movements. Given the predicted levels of construction traffic, a simple priority junction would therefore be sufficient to accommodate the reported traffic levels.

However, a number of other imperatives should also be considered in determining the appropriate layout. The design of the access road junction will ensure adequate visibility on to the main highway for vehicles leaving the site. This should be maintained by appropriate and regular vegetation clearance. Given the high percentage of HGV accessing the site, the layout should provide appropriate turning radii in order to minimise the likelihood of reversing on the main carriageway.

Temporary Traffic Management measures (e.g. one-way working) will be employed to ensure the construction of the access road does not unduly delay vehicles travelling on the main carriageway and to provide a safe environment for workers.

The Ministry of Transport (MINT) is responsible for coordinating road transport with the other modes of transport. The Ministry of Public Works (MINTP) is in charge of the construction, maintenance and protection of the road network, including urban roads, in conjunction with the competent ministries and organisations.

Permanent roads will be designed and constructed to comply with the requirements of the local highways authority. Consultation with the Provincial Officer of the MINTP indicated the technical details of the proposed road layout would need to be submitted for approval prior to construction. The exact technical specification of the access road would be dependant on the 'status' of the road in relation to the Cameroonian classified network.

If the historical records show that the access road is an unclassified rural road, previously 'opened up' by the Ministry, the government department would look to impose certain conditions to ensure wider public benefits of any future extension of the road. This could take the form of a prescribed width or the provision of ghost island left turn(s). A highway classification map is shown in Figure 5.5.4 and does not suggest this is part of the Provincial classified network, although this should be checked prior to design submission.

This piece of infrastructure could then be delivered either by MINTP under licence from AES Sonel or by an approved contractor. Indications are that the privatisation in 1994 of the execution of road maintenance works, studies and control services has favoured the rapid growth of numerous enterprises and engineering firms in the road construction sector (ADF, 2006). However, it was indicated that it was not common for third parties to oppose a connection off a provincial road.

5.5.6 Evaluation of Mitigated Impact

Increased road congestion

The transport route to the project site during the construction phase uses two main road sections - the route from Douala-Edéa and from Douala-Limbe. These have been described in detail in the baseline assessment, with a view to identifying the sensitive locations to aid developing a route management strategy.

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The Douala-Edéa section is part of the main road network within the country and already carries a moderately high level of traffic with approximately 20% of this traffic being medium to large lorries and a further 25% small lorries and buses. This road is designed and constructed to a high standard and capable of carrying heavy traffic loads. The main areas of current congestion are within Douala itself, and within the market area on the outskirts of Douala.

It is estimated that the proposed project will generate additional traffic movements on this section of road resulting in an approximate 1.2% increase over current volumes for the peak period of the construction programme. Table 5.5.2 also shows that historically, the Douala-Edéa Road, by virtue of its strategic nature, has experienced higher volumes of traffic than those predicted.

The Douala-Limbe section is also part of the main strategic road network of Cameroon. The impact of traffic along this section, however, will be lower than on the Douala-Edéa section. During construction, it will be used for the transport of sand from the Mungo River and, it will be used as the route for the estimated 12 tankers that will be required during the operation of the plant.

Due to the relatively low overall increase in traffic on both these sections, and the short duration of the peak importation of materials, impacts on congestion have been assessed as not significant. Equally, the operational phase is associated with insignificant levels of traffic, both in terms of employee and fuel movements. In the case of the latter, mitigation has been put in place to minimise any impacts through route management and other appropriate measures.

In both cases, it has also been shown that the total predicted peak traffic flows are well within the overall design capacity of a highway of this nature. As such, given the relatively low overall traffic movements and the short duration of this peak period, impacts on congestion on both sections of the route are assessed as adverse, short term and minor in significance.

Increased accident and safety risk

The potential for increased risk of accidents is related in part to the level of increase in the traffic travelling along a section of road but also to routing of the traffic in terms of use of junctions where accident risk may increase.

On both the Douala-Edéa and Douala-Limbe sections, the increases in traffic during the temporary construction and operation are such that they would not affect the relative statistical expectancy of accident events. This road forms part of the major strategic highway which is currently used by up to 4,000 vehicles per day. It has been designed to this standard and is in good condition. The contention would be, therefore, that the risks to existing users are known and would not be significantly impacted upon by the proposals.

An improved junction leading from the main road on to the access road for the plant site will be constructed. With appropriate temporary traffic management, the construction of the access road will have a minimal impact on existing traffic on the main carriageway. Overall this impact is assessed as adverse, short term and minor in nature.

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Design of the access road

In terms of design, a simple priority configuration has been deemed to be suitable for accommodating the predicted levels of traffic during construction and operation, particularly given that the vast majority of traffic will arrive from the west. However, during the course of the assessment a number of other considerations have emerged, the applicability of which will need to be investigated further when approving the final design with the MINTP.

Good practice in terms of the mitigation measures set out within Section 5.5.5 can be very effective in controlling the risks to local road users from the increase in traffic associated with the proposed development. Overall this impact is assessed as adverse, short term and minor in nature.

5.5.7 Conclusions

The overall conclusion is that the only identified impact from traffic arising from the proposed development relates to the construction phase of the project. However, depending on the final scheme for decommissioning, impacts during this phase may be similar in quantum and duration to the construction phase. Potential impacts are summarised in Table 5.5.8.

A number of mitigation measures have been proposed to minimise the impact of traffic and these will form part of the specification of the Traffic Method Statement (TMS) that AES Sonel will require the contractor to undertake and submit for approval prior to implementation of the measures, giving due cognisance to this chapter and Cameroon legislation.

In summary, the main effects of the project will only occur during the peak construction phase and during peak hours. The overall impact is therefore predicted to be insignificant. During operation, a small number of workers and HGVs are associated with operating the power plant and no impacts are predicted to occur.

Table 5.5.8: Summary of Impact Evaluation – Traffic							
Project Location	Phase²	Impact	Nature of Impact	Receptor	Nature¹	Duration¹	Significance¹
Douala - Edéa road	C/D	Increased road traffic	Congestion	Local road users	Adverse	Short-term	Minor
	C/D	Increased road traffic	Accident risk	Local residents and road users	Adverse	Short-term	Minor
Douala - Limbe road	C/D	Increased road traffic	Congestion	Local road users	Adverse	Short-term	Minor
	C/D	Increased road traffic	Accident risk	Local residents and road users	Adverse	Short-term	Minor
<p>1 – see Table 1.5.1 for definition 2 – Phase - C = Construction / O = Operation / D = Decommissioning.</p>							

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5.6 WATER RESOURCES

5.6.1 Baseline Conditions

The Dibamba area lies within the central coastal region of Cameroon characterised by the 'Maritime Cameroon' type climate. Rainfall is extremely prevalent during the rainy season July-December peaking in October. The annual average rainfall is approximately 4000mm.

The area has relatively low-lying shallow valleys forming dendritic pattern tributaries of the Dibamba River, the major watercourse of the area. The Dibamba River has a large catchment area, likely to be in excess of 1,000km² (see Figure 5.6.1), extending into the interior of Cameroon. The Dibamba River lies some 2km to the west of the proposed power station and flows south, this area is tidally influenced, characterised locally by coastal lagoon inlets and pockets of Mangrove Swamp. The Dibamba River lies too far from the site to be impacted.

A site visit was undertaken by Scott Wilson's Hydrologist in September 2007, i.e. during the rainy season. It was confirmed that in the vicinity of the proposed power plant there were no natural surface watercourses. The two most local watercourses are described in the section below.

Overall, a site investigation undertaken at the proposed site in 2007, is considered to demonstrate a representative sample of the general area's drift geology, i.e. sandy clays overlying coarser alluvial material. These ground conditions are likely to allow a degree of rainfall infiltration and probably account for the general lack of locally-sourced surface water features in the area. However, the high annual rainfall allows the potential for high recharge of aquifers.

Plant site

The proposed site sits across the summit of a low hill. As such there are no surface watercourses adjacent to it.

The site is underlain by undifferentiated gneisses and migmatites of the Precambrian age. Cretaceous sediments of marine origin followed by Tertiary and Recent deposits overlie the Precambrian bedrock within the Douala area. There is no information regarding the presence of an aquifer although it is assumed for the purposes of this assessment that the site and transmission line corridor are underlain by an aquifer. This is the worst-case scenario.

Table 5.6.1 presents a summary of the ground conditions encountered beneath the site with associated depths:

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Table 5.6.1 Summary of Ground Conditions beneath the Project Area

Description	Depth to top (metres below ground level, mbgl)	Depth to base (mbgl)
Loose, yellowish brown sandy Clay	0	7 to 10m
Reddish to yellowish brown clayey lateritic Sand with quartz nodules and concretions	7-10	8-11
Fine to coarse whitish to greyish slightly clayey Sand	7-11	11-30.5

The proposed plant site is bordered on its northern side by an existing industrial facility (a soap factory). This factory requires water for its process and this is likely to be drawn from groundwater rather than surface water, although this could not be confirmed. There is no surface watercourse locally from which water could be drawn for supply without a considerable distance of pipeline, and pumping. A similar situation will face water supply to the proposed power plant, meaning that groundwater is the likely source for general water (fire/raw water tank, for example).

Potable water is not available locally and must be brought in by tanker during construction.

The soap factory was observed to produce an effluent stream which is channelled northwards, downhill to the main Douala-Edéa road. The rate of flow appeared constant across several days, consistent with an effluent stream, and was approximately 10 l/s. From the road, the stream is channelled east within a cement canal, approximately 0.5m wide and after 100m turns southward, directly away from the road. At this point, the stream was observed to function as an informal water supply to a number of dwellings alongside. Ultimately, unless all water is abstracted, it is likely that the effluent joins the larger surface water catchment to the south of the proposed site, a tributary of the Dibamba River.

No regular flow gauging or water quality assessments are undertaken on any of these watercourses and as such no existing baseline data have been identified. The apparent minor sensitivity of surface water does not warrant a baseline monitoring programme to be set up as part of the ESIA.

At present a groundwater survey has not been completed so the depth and quality are unknown. AES Sonel do however anticipate that the borehole will need to be in the region of 80m below ground level. Once the borehole has been drilled AES Sonel will complete various water quality tests. However as most of the project area is within a rural setting significant water pollution from human activity is unlikely to have occurred although, there is potential for point source pollution, for example from industrial units like the soap factory.

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Transmission Line route

There are no watercourses that cross the transmission line route or its wayleave.

The hydro-geological situation is likely to be similar to that described for the proposed site, with the depth to the aquifer (if there is one present), being variable based on topography.

Water use

General water use has been established from on-site interviews and information gathered during the household surveys conducted as part of the social impact assessment (SIA) (see Section 6).

The majority of those interviewed (68%) draw their water from a local borehole source, supporting the on-site observations that surface watercourses are too rare or of insufficient yield generally to support the local population. This fact also focuses the social impact aspect of this water chapter on groundwater sources rather than surface water resources.

Those who do not draw water direct from a borehole source obtain it via taps either in their own yards or villages. These appear to be sourced from water supplied by the water company 'Sawawa'. It is unknown whether Sawawa source their water locally or bring it into the area from elsewhere.

5.6.2 Potential Environmental Impacts

The key potential impacts on water resources that can arise from a power plant development relate to:

- *Contamination of local surface watercourse* either by soil erosion and silt discharge or via spillage or discharge of potentially contaminative materials;
- *Alteration of the amount of water within local surface watercourses* either by increasing or decreasing catchment run-off characteristics or by over abstraction;
- *Reduction of the overall groundwater resources* of an area as a result of abstraction; and
- *Pollution of existing groundwater supplies* so impacting their potential use.

Contamination of local surface watercourses - erosion

Construction

The creation of access tracks and general site activity during construction has the potential to result in the creation of bare ground and therefore increased soil erosion potential, particularly in areas of sloping ground. This will be of particular importance at the plant site where large areas of clearance and regrading will be required to facilitate the construction.

Along the transmission line route, construction areas at the base of the pylons will be relatively small, typically 25m² allowing for working areas, so erosion risk will be low. In addition it is not the intention to remove vegetation and strip soils to create an access track

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along the wayleave route but to traffic over cleared vegetation. However, the project area is subject to high rainfall and ponding in rutted areas of tracks may occur. This can lead to increased soil erosion.

Where erosion occurs in close proximity to a river system, heavily silt-laden water can be discharged to streams during heavy rainfall events. If not adequately controlled, this can result in increased turbidity within the river and have water quality/ecology implications. In addition, reduced water quality will affect the local population who use rivers for water supplies.

However, the nearest surface water receptor is approximately 500m west of the plant site (and a similar distance from the transmission line route), meaning that the release of any eroded sediment during construction will be effectively buffered by un-impacted, vegetated land.

Operation

Following the construction phase, disturbed areas will be allowed to revegetate. Maintenance of the transmission line does not require a dirt road along the wayleave. Therefore there are no identified impacts from soil erosion during the operational phase of the project.

Decommissioning

Decommissioning is effectively a reversal of the construction process and therefore potential impacts will be similar.

Contamination of local surface watercourses - chemical

Construction

The storage and use of oils and chemicals has the potential to result in spillage, which may in turn runoff and discharge to surface water systems. This is of main concern at the plant site where temporary storage of fuel oils for the construction fleet will be required, but spillage from vehicles at the transmission line construction site may also occur. Contamination of surface water has the potential to affect local community water supplies and to impact on the aquatic flora and fauna of local watercourses.

In addition, poor control of on-site sanitary facilities for workers may result in human waste being discharged to streams with a resultant increased risk of illness within communities using streams as drinking water sources.

Operations

The main risk during the operational phase is from a potential spill from the bulk diesel fuel storage required to provide fuel supply. There are also a number of other storage tanks on site for lubrication oil, sludge and oily-water. In total, these storage tanks have a capacity of over 4,000m³.

In addition, the uncontrolled discharge of foul water from the staff welfare facilities on site may result in pollution of the surface water system.

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Both construction and operation impacts are generally unlikely because of the lack of surface water receptors. However, the disposal method for site-generated water has yet to be determined for both construction and, most importantly, the operation phases. Four options appear possible at this time:

1. Disposal to the soap factory effluent stream;
2. Disposal to ground via a soakaway;
3. Disposal to the watercourse approximately 500m west of the site; and
4. Storage on-site and collection by tanker.

Decommissioning

As set out for soil erosion above, decommissioning being a reversal of the construction process results in the same or similar potential impacts as from that phase. Use of fuels and oils and the presence of a workforce leads to potential discharges of contaminative materials to surface water.

Alteration to the flow of local watercourses

Construction and operation

Flows in surface watercourse can be impacted in two primary ways: abstraction causing a reduction in overall river flows, and alteration of the ground surface cover of a river catchment so impacting run-off characteristics (creating more or less runoff).

During the construction phase, it is intended that the main water source for site operations and, concrete production, particularly along the transmission line, will come from groundwater sources, as is the norm at other AES Sonel power plants in Cameroon. It may therefore be that surface water (baseflow) in local watercourses could be impacted due to a localised lowering of the groundwater table. However, the water yield required from the borehole is relatively small in comparison with the probably size of the local aquifer.

A second option for water supply during construction is external import via tanker. This water will be sourced from outside of the immediate area, possibly from a large source such as the Dibamba River, and hence impact will be negligible.

Construction and operation of the plant area itself will require vegetation clearance and the establishment of a generally impermeable surface. This change will result in an increase in rainfall runoff on site which has the potential, if unmitigated, to increase overland flow to local surface water receptors, particularly the watercourse approximately 500m south and down-slope of the site. This could result in an increase in flow within the watercourse, although the buffer distance is likely to be sufficient to ameliorate this.

The plant site and the transmission line wayleave occupy very minor percentages of overall river catchments of the area. Therefore no significant effect is predicted to arise.

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Decommissioning

Decommissioning impacts could be similar to those possible during the construction phase. However if decommissioning includes re-establishment of soil surfaces and vegetation cover, then any run-off changes will be returned to pre-construction levels. There are therefore no additional impacts associated with decommissioning.

Depletion of groundwater resources

Over abstraction of groundwater resources (removing greater quantities of water than are being recharged to the system) can lead to reduced groundwater levels in local wells, so restricting local supply. This may cause impacts on long-term availability of the resource. However, the projected water demand for the power plant is low.

At this time, it is assumed that all phases of the site or transmission line development will utilise groundwater resources for water supply. However, it is not known whether there are sufficient resources, of sufficient quality, to make this source a reality.

Construction

During the construction phase, it is intended that the main water source for site operations, , will come from groundwater sources. It may therefore be that groundwater resources locally are under pressure already and an additional borehole may not be sustainable or cause impact upon the existing supply quantity to the soap factory.

A second option for water supply during construction is external import via tanker. This water will be sourced from outside of the immediate area, possibly from a large source such as the Dibamba River, and hence impact will be negligible.

Operation

The technology to be used for this project has a low total water demand. Cooling will use closed circuit water cooling with very limited topping up required and few other demands exist, such as for compressor wash. Total process water demand is likely to be only 2m³ to 3m³ per month. Therefore, the main water demand at the plant site will be for staff welfare use and domestic purposes. The intention is to use groundwater sources for this supply, as is the norm at other AES Sonel power plants in Cameroon. Detailed water demand figures have not been established at this stage but demand can be estimated from staffing levels. The site will operate three 8-hour shifts with approximately 10 to 15 operational and maintenance staff per shift. In addition, during the daytime shift, approximately 5 management and administration staff will be on site.

A typical daily demand per person (domestic) would be in the order of 60 to 150 l/day (UNESCO, Water Use in the World: Present Situation/Future Needs, 2000). Based on a total of 20 staff on site for any 24 hour period, at the higher use rate estimate, the total daily demand will be in the order of 3m³ or a pumping rate of approximately 0.03 l/s. Thus, demand and pump rates are very low.

During the operational phase, there will be no demand for water use along the transmission line.

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The existing soap factory to the north is believed to use a groundwater borehole for its operational supply. It may therefore be that groundwater resources locally are under pressure already and an additional borehole may not be sustainable or cause impact upon the existing supply quantity to the soap factory.

The operational area will be approximately 4ha, much of which will be composed of impermeable surface – either asphalt hard standing or roof area. This level of impermeable surface has the potential to prevent the natural infiltration of rainwater and hence overall recharge of the groundwater aquifer which is likely to exist below.

Overall, there may be significant impacts on groundwater resources arising from the operational phase of this project.

Decommissioning

The potential impacts during and post decommissioning will be dependent on the nature of the closure strategy developed for the site. Should any water supply established (e.g. a borehole) be made available to local residents post closure then the abstraction would continue and no change from the operational status would be anticipated. Should a new development come on to the site then the water use will be dependant on the type of development. However, this would be subject to separate assessment at the time of the detailed decommissioning planning.

On the basis of the closure and removal of all current planned operations at decommissioning the demand for potable and process water will no longer exist and therefore potential impacts on depletion of groundwater resources will be removed.

Pollution of groundwater resources

Groundwater resources are vulnerable to potential impacts from pollutants leaking or spilt on the ground surface that may seep into an aquifer. In relation to the Dibamba power project this potential relates primarily to the storage of fuels and oils and the discharge of domestic effluent from the site.

Construction

During the construction phase only small volumes of fuels and oils will be required on site. These will consist of fuel storage for on-site vehicles either in mobile bowsers or within small on-site storage tanks. The transport fleet will refuel at existing roadside fuel stations and will not require on-site storage. The construction will also involve the storage and use of greases and cleaning agents and similar materials but these will only be required in small quantities and are not anticipated to represent a significant risk to the water environment.

Mobile and construction plant also have fuel tanks that represent a potential source of pollution if rupture or spillage occurs during refuelling. However, volumes of these tanks are relatively low and even a major rupture is unlikely to cause pollution of the groundwater as these volumes would tend to be absorbed by the soil's upper layers where rapid excavation could usually catch any downward migration.

At the peak of the construction phase, approximately 480 workers will be employed at the plant site and along the transmission line corridor. Whilst peak work activity will only

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occur for a short period, this number of staff has the potential to cause discharge of untreated sewage and wastewater, to groundwater. This may cause organic pollution of the groundwater with commensurate increase in risk of illness where groundwater supplies are utilised.

Operation

The main risk during the operational phase is from a potential spill from the bulk diesel fuel storage required to provide fuel supply. There are also a number of other storage tanks on site for lubrication oil, sludge and oily-water. In total these storage tanks have a capacity of over 4,000m³.

Any major spill or long-term leakage from a tank of this capacity could have a significant impact on groundwater resources. In addition, the uncontrolled discharge of foul water from the staff welfare facilities on site may result in pollution of the groundwater.

During the operational phase, there will be no activity along the transmission line that will require the storage and use of any potentially contaminative materials. There are, therefore, no identified potential impacts along the transmission line during this phase.

Decommissioning

During the decommissioning activities, the potential impacts on groundwater pollution will be similar to those of the construction phase. Post closure all sources of potential pollution will be removed and no further risk of impacts on groundwater quality will exist.

5.6.3 Mitigation Measures

Contamination of local surface watercourses - erosion

During construction, the developers of the power plant will undertake to protect earth slopes and any receptor ditches against erosion. This will entail the use of grass mats and crush rock aggregate covering. In some hard wear locations, geotextiles may be used. Silt fences will be installed at the down-slope extremes of the plant site and transmission line working areas.

During operation, any runoff generated from the site will be controlled via appropriate attenuation control methods. No discharge will be made directly to an unprotected or unstabilised area of open ground or watercourse.

Contamination of local surface watercourses - chemical

The controls for the storage and handling of potentially contaminative materials are well established and widely used. For the Dibamba project, this will include the following:

Construction phase

- Installation of portable or pit latrines for workers during the construction phase to ensure control of discharge of foul water.

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- Installation of temporary bunding around oil storage tanks used on site during construction.
- Loading areas will be bounded by lined interceptor trenches to prevent runoff or wash off or spillages or oil/diesel splashes by heavy rain.
- Storage of all grease, cleaning agents and similar materials within a secure container (metal hut or similar) to stop theft and tampering. Container to have a solid watertight floor and raised lip to contain any minor spillage.

Operational phase

As for construction phase but also to include:

- Back up fuel oil storage tank at the plant site to be constructed within a fully water tight containment bund. The basic design standard will require a bund to retain a minimum of 110% of the volume of the contained tanks, will have a sump for removal of rainwater and all feed and delivery pipe works and pumps will be within the bund. All delivery areas will be on hard standing with slopes to a collection sump to contain any spillage during delivery.
- All delivery and discharge pipe work for fuels will be installed above ground to allow full inspection for damage or leaks.
- Transformers will be constructed with catch pits below each unit designed to hold the full capacity of the oils contained within the unit. Catch pits will have drainage sumps to allow removal of rainwater and any oil spills.
- Drainage running from maintenance workshops will be fitted with an oil separator.
- All foul sewage from the site will be fed to a septic tank system or similar for treatment prior to discharge to any receptor.

Decommissioning

- Control measures as per the construction phase will be implemented.

For all staff welfare areas and on the construction site, suitable sanitary facilities will also be installed. On construction sites these may be simple pit latrines. On the plant site, all staff welfare facilities will have septic tank drainage or similar systems installed to ensure foul water is treated prior to discharge to surface or groundwater or is collected by tanker.

To ensure full maintenance and management of these systems once constructed, an environmental management plan (EMP) will be implemented at the site. A framework for this plan is included within the EMP report (see Section 7).

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Alteration to the flow of local watercourses

Overall water abstraction for the project is very low and therefore no specific mitigation measures are proposed for this aspect of the works should a surface watercourse be identified which could meet the resource demand. This however is unlikely.

To minimise impacts, vegetation clearance will be conducted in such a way as to ensure that the vegetation system is not fully removed and will therefore re-grow along the transmission line where possible. This will be ensured by controlling clearance to retain at least 40mm to 60mm of vegetation height above the ground. A full surface cover will therefore be retained. In addition, vegetation clearance will be undertaken at the start of the dry season and therefore some degree of re-growth will occur before the rainy season begins.

No unattenuated discharge of site runoff will be made to any local watercourse. An adequate drainage collection and storage system will be implemented on-site, reducing any peaks in runoff and spreading the rate of off-site drainage through time to minimise impacts in surface water receptors.

Depletion of groundwater resources

This impact relates primarily to the operation phase, when a low water demand for operational plant and on-site workers has been identified. Should this water be drawn from the probable groundwater aquifer below the site area there will be a need to ensure that abstraction is limited. To assess what a safe level of yield will be, a full groundwater yield assessment should be undertaken. Discussions with the operators of the soap factory should be undertaken to assess the source, nature and scale of their water supplies. Similarly, further hydrogeological assessment may be required regionally to determine the level, and hence acceptability, of impact to local users.

Pollution of groundwater resources

The mitigation measures proposed above for 'Contamination of local surface watercourses - chemical' during all phases will be used and ensure that the potential for pollution of groundwater resources is mitigated satisfactorily.

5.6.4 Evaluation of alternative development options

None of the project alternatives have a significant effect on the overall potential impacts on surface water from the proposed development.

The zero (no project) option would remove the potentially negative impacts that may arise from the construction and operation of the project. However, no significant impacts have been identified.

5.6.5 Conclusions

This impact assessment has focused on both surface water and groundwater receptors.

Overall, the potential impact upon groundwater resources, both in terms of resource availability and quality, has greater significance than for surface water. This is largely due

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to the absence of any local surface water receptor which could easily be linked to the power plant development (pathway).

However, there is likely to be a groundwater resource (aquifer) of some size beneath the site. Aside from the intrinsic requirement to ensure that it is not adversely affected, other local users almost certainly use the aquifer.

The overall assessment of impact has concluded that the majority of effects are minor or insignificant. No significant impacts are expected as a consequence of the transmission line construction or operation.

Potential impacts are summarised in Tables 5.6.2 and 5.6.3:

Table 5.6.2: Summary of Impact Evaluation – Surface Water Resources							
Project Location	Phase²	Impact	Nature of Impact	Receptor	Nature¹	Duration¹	Significance¹
Plant site	C/D	Water quality	Soil erosion	Surface water users / Environment	Neutral	Short term	Insignificant
	O	Water quality	Soil erosion	Surface water users / Environment	Neutral	Short term	Insignificant
	C/D	Water quality	Fuel / site drainage / foul water discharge	Surface water users / Environment	Adverse	Short term	Insignificant
	O	Water quality	Fuel / site drainage / foul water discharge	Surface water users / Environment	Adverse	Medium term	Minor
	C/O/D	Flow alteration	Change in run-off	Surface water users / Environment	Neutral	Medium term	Insignificant
	C/O/D	Reduced surface water resources	Abstraction for site water supply	Surface water users / Environment	n/a	n/a	n/a
Transmission line	C/D	Water quality	Soil erosion	Surface water users / Environment	Neutral	Short term	Insignificant
	C/D	Water quality	Fuel / site drainage / foul water discharge	Surface water users / Environment	Neutral	Short term	Insignificant
	C/O/D	Flow alteration	Change in run-off	Surface water users / Environment	Neutral	Medium term	Insignificant

1 – see Table 1.5.1 for definition
2 – Phase - C = Construction / O = Operation / D = Decommissioning.

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Table 5.6.3: Summary of Impact Evaluation – Groundwater Resources

Project Location	Phase²	Impact	Nature of Impact	Receptor	Nature¹	Duration¹	Significance¹
Plant site	C/D	Water quality	Fuel / site drainage / foul water discharge	Groundwater users / Environment	Adverse	Short term	Minor
	O	Water quality	Fuel / site drainage / foul water discharge	Groundwater users / Environment	Adverse	Long term	Insignificant
	O	Reduced Groundwater resources	Prevention of recharge	Groundwater users / Environment	Adverse	Long term	Minor
	C/D	Reduced Groundwater resources	Abstraction for site water supply	Groundwater users	Neutral	Short term	Insignificant
	O	Reduced Groundwater resources	Abstraction for site water supply	Groundwater users	Adverse	Long term	Insignificant
Transmission line	C/D	Water quality	Fuel / site drainage / foul water discharge	Groundwater users / Environment	Adverse	Short term	Minor
1 – see Table 1.5.1 for definition 2 – Phase - C = Construction / O = Operation / D = Decommissioning.							

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5.7 LANDSCAPE AND VISUAL

5.7.1 Baseline Conditions

The project area is located within the coastal lowlands of southwest Cameroon (see Figure 1.1.2), which consists of flat alluvial coastal plains with mangrove and forest cover leading into slightly higher, gently undulating, lowland hills.

The project area itself is primarily within the lowland hills with a rural landscape of highly disturbed, fallow land and scrub. This dominates the landscape character of the area (see Photos 5.7.1 and 5.7.2) with settlement and agricultural clearings being secondary landscape features. The topography is one of very low rolling hills or hillocks and shallow valleys. The main residential area of Yassa Village is located south of Yassa junction near the proposed connection to the existing transmission line.

The major introduced features, that influence the landscape character of the project area, are the main Douala/Edéa road and the existing 90kV power transmission lines that cross west of Yassa junction on a north-south alignment and to which the Dibamba power plant will be connected. The road comprises a 7m wide carriageway with up to 1m tarmac verge (see Photo 5.5.1). A soap factory with buildings of significant height lies immediately north of the site, between the site and the road. The soap factory dominates the local landscape. A coffee factory is being constructed on the north side of the main road opposite the soap factory.

The general landscape character is therefore one of low ecological value, on gently rolling low hills interspersed with human settlements, subsistence farming and a main road and power lines. Yassa Village is located along the proposed 1.8km transmission line corridor.

In general 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 local area. From road and house level all main views are therefore limited to the close surroundings or occasional long views, for example, along the current road line.

The main change in this landscape character is around Yassa junction at the western end of the transmission line route. Here the village and junction dominate the landscape. The vegetation in this area has been cleared to a greater extent than along the rest of the route. Due to the greater degree of clearing and the higher population density, more extensive views are present from properties around Yassa.

At the plant site itself, a significant proportion is utilised for subsistence agriculture and the old fallow land and scrub is relatively dense and heavily overgrown. Views are limited to the close surroundings and medium distance views of the surrounding low-lying hills (see Photos 5.7.1 to 5.7.6).

The plant site is located on the brow of a low-lying hill, with the existing topography of the site at a maximum of approximately 57m in its north-west corner, sloping away to the south-east to approximately 45m.

No areas of specific landscape protection, either international or national, were identified during the baseline assessment.

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5.7.2 Potential Impacts

The current landscape includes features of similar character to those that will arise from the development, i.e. linear features of another transmission line and buildings 9.5m high with a slowly rising pitch roof to 11.9m, which will be situated to the south of an existing set of large building structures. The features that will stand out the most will be the eight 40m high stacks.

During the construction phase, the proposed site and wayleave will be cleared of all vegetation. This will be a total area of approximately 13.82ha. As the existing vegetation is relatively low, the visual impact of clearance considered insignificant. During the operational phase, the impacts are considered to be greater and have been identified below:

- Clearance of vegetation along the wayleave for the transmission line corridor (1.8km by 30m) altering the landscape and visual setting of the area;
- Construction of a maximum of fifteen new 29m to 36m high voltage self supporting steel lattice towers along the transmission line; and
- Clearance and construction of the power plant, including 40m emissions stacks, at the plant site, so altering the current rural nature of the area and visual impacts on the locality.

Overall, landscape and visual impacts are assessed on two basic levels. Firstly, via an assessment of the alteration of the intrinsic landscape character of an area irrespective of whether there are views of that landscape. Secondly, a visual impact assessment i.e. impacts on people's views either from residential properties or areas of public access such as along roads and paths.

Impacts on landscape character

Impacts on landscape character are assessed against the baseline of the general landscape setting as well as any specifically designated areas of landscape protection. Such designated areas are of high sensitivity and require greater consideration in terms of mitigation. However, in relation to the Dibamba Power Project, no areas of specifically protected landscape exist, therefore impacts are set only against the general landscape character.

As noted within the baseline section, most of the route consists of low rolling countryside with vegetation cover, river valleys and scattered settlements. Onto this has been imposed the Douala/Edéa road, the existing 90kV power transmission lines, near Yassa Junction and the soap factory adjacent to the plant site.

The impacts of this project on this existing landscape character result from three main elements, first the clearance of a 30m linear strip of vegetation for the wayleave, second the construction of a maximum of fifteen 29m to 36m high 90kV towers with the power line strung between them, and finally the clearance of the plant site and construction of the power plant building and associated structures. Whilst final design is not yet complete the main turbine houses, which will be the largest buildings at the plant site, will be in the order of 11.9m high. The tallest structure, as previously identified, will be the stacks for discharges of spent gas from the engines. These will consist of two groups of four

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individual stacks located alongside the power house (see Figure 3.3.1) each stack having a height of 40m.

Visual impacts

The transmission line corridor has been designed, where possible, to avoid crossing over residences and properties along its route which runs parallel to the main road. The majority of the population in the area, other than Yassa Village, are located along and close to the road. The line will pass within a few hundred metres of these areas. The majority of the route however, is sparsely populated and runs predominantly over subsistence agriculture and bush. Despite this, the transmission line is likely to be visible to the population in the surrounding area. Views will also be afforded to occupants of vehicles travelling along the main Douala/Edéa road.

The main elements that may be visible will be the pylons. Whilst the vegetation clearance, will be visible, there will still be a green, vegetated backdrop. The vegetation clearance will not therefore be as visually intrusive as the new high tower structures of up to 36m tall (depending on the topography).

At the plant site, the closest properties are adjacent to the access road and within relatively close proximity to the site (closest house within 200m of the plant site boundary) and therefore will have views (Photo 5.7.4). The closest residences already have views to the east dominated by the soap factory, which is estimated to have structures of a similar height to the maximum of the proposed plant structures, at 11.9m high (see Photo 5.7.4 to 5.7.6). However, the most visual element of the plant will be the stacks, which will be 40m tall, as such views will be impacted.

5.7.3 Mitigation Measures

Impacts on landscape character

The primary impact on the landscape character of the area relates to the introduction of new visual elements. To mitigate this, the transmission line has been routed parallel to the existing areas of landscape disturbance caused by the main road and associated activities. These elements already detract from the natural landscape of the area and therefore this route, avoiding virgin, undisturbed areas, has provided partial mitigation of the overall impact. The new features to be introduced will be of a similar nature to the existing elements west of Yassa Junction.

In addition the selection of the design of the tower influences overall impacts. Double circuit towers have been selected allowing a relatively low tower design to be adopted.

The plant site is not an entirely new form of development within the existing setting with the soap factory located immediately to the north of the plant site, the road beyond, and with additional construction works for a coffee factory opposite the soap factory. The area of land required for the development and the height and size of the buildings cannot be significantly altered. Locating the development near existing factories and in a disturbed landscape reduces the significance of impacts. As such, there are no specific mitigation measures developed to offset the landscape impact of the plant.

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It is proposed that the buildings and stacks are painted either white or grey so as to make them blend in with the sky. This would be less intrusive than the present bright blue adjacent soap factory.

Visual impacts

The primary method for the mitigation of visual impacts relates to the route selection for the transmission line, the site location for the plant site and the design of the structures being introduced.

The route selection process has a number of criteria that need to be satisfied and the final selection is a balance between the various potential environmental impacts (e.g. ecology, landscape, land use) and operational factors. This balance has resulted in the line being designed to take a direct route to its connection with the existing 90kV transmission line to the west, providing a dogleg to avoid significant numbers of properties in the area. This does however potentially bring the line close to residential properties and within several hundred metres of the road-side activities in the area. Selection has been modified, where practical, to provide the maximum separation distance to existing residences so as to reduce visual intrusion as well as avoid property and cultivated land.

At the plant site, the location of the actual power plant within the overall 7.7ha site has been selected to maximise, where possible the separation distance to the properties in the area and the main road. As shown on Figure 3.3.1 the compound boundary is set back approximately 200m from the nearest property and 250m away from the road.

This site layout also provides the opportunity to enable a belt of vegetation to develop in the north between the site and the properties and the main road and to the east, although much of this will temporarily need to be cleared for the construction compound. In addition, once construction is complete, this area can be left to re-vegetate naturally. A partial visual screen to the plant site will therefore be developed.

There are also discussions currently being held with the engineering design team about the potential of having the site on two levels and using the excess spoil from excavation and site levelling to create an earth bund to the north of the site between the site and the soap factory. This bund will then be left to re-vegetate naturally. The small area to the west between the entrance and exit roads will be landscaped and maintained properly.

5.7.4 Evaluation of Mitigated Impact

Impacts on landscape character

The project does not involve any major remodelling of the landscape, such as may arise from say a mining project, the main impacts on the landscape character being only the introduction of an additional transmission line adjacent to the existing road corridor and the construction of the plant.

In relation to the transmission line, the selected route parallels the main road. Transmission line towers and clearance of vegetation for the wayleave is an existing element of the landscape near Yassa Junction. The introduction of a transmission line along the route will create an impact for approximately 1.8km. This introduces a new element into the

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landscape. The towers to be used for the new line are to be up to 36m in height and will therefore stand above vegetation throughout the length of the route.

Overall the introduction of the 1.8km transmission line within the existing disturbed landscape along the main transport corridor is assessed as having an adverse, long-term but minor impact on landscape character.

For the power plant, a completely new element of an industrial nature will be introduced into what is currently an existing, and likely increasingly, industrial setting. However, the overall area of development (approximately 4ha) is small-scale in terms of the extensive nature of the fallow and scrub landscape within this district. Whilst this new element will alter the current landscape character, this area is not specifically designated as a protected landscape and the small area of impacts is not significant in terms of the overall landscape setting. This impact of the plant site on the landscape character of the area is therefore assessed as having an adverse, long-term but minor impact on landscape character.

Visual impacts

The visual impact from the development will differ for the transmission line and the power plant.

Transmission line

The route of the new transmission line runs parallel to the main road for its entire length. The towers are up to 36m in height, therefore extending above the current vegetation, and the wayleave clearance width is 30m. In addition the zone of visual influence of any one property is limited due to the low, rolling landscape (no high vantage points) and the vegetation cover which results in limited long distance views from properties, villages or along the road.

By following the main road corridor the line will run close to properties and change the views of occupants and road users on the main Douala-Edéa highway. However, due to the presence of some vegetation cover, views from any one property will be partially obscured. The most visible points will be where it crosses roads, tracks or is taller than the surrounding vegetation cover.

The overall impact on visual amenity of people along the transmission line route is therefore assessed as adverse, long-term but minor in significance.

Power Plant

The power station is a totally new element in the landscape. However the selected location for the operational area (4ha) within the overall 7.7ha plant site, maximises the potential for a vegetation buffer. The plant site is also set back approximately 250m from the road behind the soap factory and will be on different levels (the south side being lower) although exact heights are still to be decided. The plant will also be approximately 200m from the nearest property. The road level in the area is set at a lower elevation than the plant however the soap factory already interrupts the short distance views (see Photo 5.7.4). In addition to this the closest properties are set within relatively dense vegetation cover (see Photo 5.7.7) which further screens views. Due to the undulating nature of the surroundings, medium distance views may be naturally screened in parts. The construction compound area will be

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subject to a degree of clearing during the construction phase but, where practical, vegetation will be retained to provide a screen to the works. This area can also be left to revegetate following construction to provide long-term screening from adjacent properties and the road. The main buildings are only 11.9m in height. Their impact will be reduced by the undulating topography; the potential retention of a screening belt; the colour of the structures; the stepped site level; and the climate of the area, which leads to rapid vegetation growth, thereby enabling a good visual screen to develop relatively quickly. The plant site will be surrounded only by a chain link fence, which will be approximately 5m height, so not limiting any views into the wider site. The main element that will be visible will be the 8 emission stacks, in two groups of 4, from the turbines. These are 40m in height and will therefore be visible from both nearby properties and longer distance receptors. However, these will form only a small proportion of the views, only dominating local views, which will be partly reduced through the measures described above.

Taking account of the selection of the plant site, the limited number of properties in close proximity to the plant, the ability to screen the plant from public views and the small dominance of views of the stacks in the surrounding landscape, the impact on the visual amenity of the area is assessed as adverse, long-term but minor in significance.

5.7.5 Evaluation of alternative development options

The main alternatives that would affect the visual impact are the selection of single circuit transmission line towers and the setting of the plant site back from the road and a reduced stack height.

The option of a single circuit power line was not considered due to technical constraints as one circuit is coming from grid dispatch centre & another circuit going to Ngodi-Bekoko substation.

The stack heights are set at the minimum allowable level to ensure the World Bank Guidelines for air quality are not exceeded. Therefore, the stack height of 40m is the only available height.

The zero (no project) option would remove the potentially negative impacts that may arise from the construction and operation of the project. However no major significant impacts have been identified.

5.7.6 Conclusions

In overall terms, the introduction of an additional power line along the corridor of the main road, and the construction of the power plant, are assessed as having only minor impacts on the landscape character and the visual amenity of the local population.

The project area is covered by vegetation, views from road and house level are relatively limited and vegetation screening, particularly of the plant site, provides effective mitigation. The area of land take is also relatively small in terms of the overall vegetated landscape of the district and therefore impacts are at a small scale.

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Table 5.7.1: Summary of Impact Evaluation – Landscape and Visual

Project Location	Phase²	Impact	Nature of Impact	Receptor	Nature¹	Duration¹	Significance¹
Plant site	O	Landscape character	Industrial feature in rural setting	Landscape	Adverse	Long-term	Minor
	O	Visual amenity	Industrial feature in rural setting	Local population	Adverse	Long-term	Minor
Transmission line	O	Landscape character	Additional power line	Landscape	Adverse	Long-term	Minor
	O	Visual amenity	Additional power line	Local population	Adverse	Long-term	Minor
1 – See Table 1.5.1 for definition 2 – Phase - C = Construction / O = Operation / D = Decommissioning.							

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5.8 LAND USE

5.8.1 Baseline Conditions

In September and November 2007 surveys were undertaken in and around the project area to determine the current land uses. This information combined with data gathered from satellite imagery produced by Douala's Urban Council Cartography Department (Figure 1.1.4), information recorded as part of the project area topographic surveys completed by AES Sonel in September 2007 and the Census Commission Report issued by the Census Commission in December 2007 has enabled a clear understanding of the present land use situation.

The project area, as shown on Figure 1.1.2 and 1.1.4, extends from near the existing soap factory to the Yassa Junction, a distance of under 2km. The site is situated in a gently undulating landscape.

The power station is located in Douala 3 which is known in Cameroon for its high percentage of industrial land use.

Land use

The project area is subject to high rainfall with two wet seasons (in May and October) each year. This, combined with the poor nutrient status of soils (resulting in shifting subsistence agriculture), has greatly influenced the pattern of land use and vegetation cover.

A soap factory is located immediately to the north of the plant site.

The topographic and Census Commission surveys have shown the following land use cover along the transmission line corridor:

- 30% subsistence agriculture;
- 52% bush/scrub;
- 16% concessions; and
- 2% road.

At the plant site the land use is dominated by subsistence agriculture.

In the project area it is considered that the forest historically dominated the area, however the forest is no longer present due to clearing. The project area is now considered to comprise predominantly scrub (see Section 5.9). The land use is undergoing another change and scrub is being replaced with subsistence agriculture, producing crops such as Yam, Macaba, Manioc, Pineapple, Sugar Cane, Potato, Banana, Oil Palm, and other staple foods. These are being grown both within the plant site and along the transmission line corridor.

5.8.2 Potential Environmental Impacts

The primary impacts on land use arise from the need for land take and land clearance to facilitate the development of the proposed power plant (a total of 7.7ha) and transmission line corridor (a total of 5.4ha). Impacts arise during both construction and operation with most changes being permanent in nature.

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Direct loss of land

A summary of direct land loss is provided in Table 5.8.1.

Construction

Direct loss of land occurs at the plant site and at the base of the towers on the transmission line. As noted within the project description, the step down transformers at Ngodi-Bekoko Substation will be within the existing substation compound and therefore no new land take will be required at this site.

The land take required at the base of each transmission line tower will be approximately 5m by 5m (total land take of 25m²). The towers will be spaced at a nominal distance of between 100m and 300m, depending on the terrain and routing requirements. Therefore, actual land take over the wayleave, on the basis of a 1.8km line and a maximum of approximately 15 towers, will be about 0.04ha. No other land take is expected within the wayleave.

The area designated for the construction of the plant site is approximately 7.7ha in total. This land take includes 4ha operational area, the temporary construction compound and laydown area. The plant site will be fully fenced and the site cleared of all vegetation, then the ground surface will be re-graded and levelled as required for the construction of the access road, temporary site offices, and power station and ancillary facilities.

There will be a permanent change in land use of approximately 4ha, however the non-operational area to the north and east of the site (approximately 3.7ha) will be left to naturally re-vegetate.

The dirt track accessing the site from the main Douala-Edéa road will be permanently surfaced for approximately 800m with a width of 9m equating to a land take of 0.72ha, excluding drainage channels.

Operation

During the operational phase all the land taken for the construction of the power station will be permanently lost, including operational area, access road and transmission line tower bases, the remaining 3.7ha non-operational area will be allowed to re-vegetate. The fence that will be erected during the construction phase will remain for the operational phase. Along the wayleave, the vegetation will be allowed to grow to a maximum height of 2m.

Decommissioning

At decommissioning, the plant site and the tower base foundation areas can be returned to their current land use following removal of all buildings and structures. At the plant site the soils will be in a poorer condition (compaction, loss of top soils, etc) than their current state and therefore agricultural activity may not be practical. This area is therefore likely to return to a scrub cover.

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Decommissioning allows mitigation of the impacts caused during construction and operation, via the restoration strategy. Therefore there are no identified impacts following this phase.

Project area	Land take (hectares, ha)	Type of land take
Construction compound / non-operational area of plant site	3.7	Temporary clearance
Operational area of plant site	4	Permanent
Access road	0.72	Permanent
Transmission line tower bases	0.04	Permanent
Transmission line corridor / wayleave	5.4	Vegetation removal

Land use change

Construction

At the plant site it has been assumed for the ESIA that the 7.7ha area will be fenced and access controlled. Therefore land uses (4ha – operational plant site and 3.7ha – non-operational plant site) will be restricted under ownership by AES Sonel for the purposes of the construction of the project.

During the construction phase, vehicle access by plant and machinery will be required along the transmission line to remove timber during wayleave clearance, and for delivery of men and materials. This access will result in the removal of existing activities including the loss of any crops that are present. The full 30m wayleave strip may not be required for this construction access. Only the areas surrounding the transmission line tower bases will be fenced during this phase, however farming activity throughout the entire transmission line corridor is likely to be restricted. All current land uses would be lost during construction.

Surveys of a sample of the 38 households affected identified that the majority of the project-affected people live by subsistence farming with some cash income gained from informal roadside business, such as fruit-selling. 78% of the employment of people affected is either subsistence agriculture or informal sector. Impacts on livelihoods is assessed in Section 6, Social Impact Assessment.

Estimated construction time is approximately 15 months for the entire project. The construction of the whole transmission line will take approximately 8 months, depending on the final number of towers required. The significance of the disruption to crops will be dependent on the time of year works are conducted.

Construction also requires the removal of any built development within the wayleave, the route of the transmission line has been designed to avoid residences and properties as much as possible and where practicable. Impacts in relation to compensation and resettlement are dealt with within Section 6.

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Operation

Vegetation within the wayleave will be maintained at or below 2m in height.

Experience from other projects indicates that informal farming will occur within the transmission line corridor during operation of the power station. The only agricultural land use that would be affected by the development would therefore be tall crops, primarily being fruit trees, oil palms and bananas. However, it has been assumed for the Social Impact Assessment and resettlement / compensation assessments that no informal agriculture will occur within the wayleave during operation, see Section 6.

However, the right to use the land within the transmission line corridor will lie with AES Sonel for the Dibamba Power Project. Any farming that is undertaken within the line will be undertaken at the risk of the farmer as AES Sonel will have the right to remove crops and vegetation cover within the designated wayleave if necessary for maintenance.

Decommissioning

Following decommissioning there will be no on-going restriction on land use within the wayleave and the area can revert to the current or other desirable uses.

Decommissioning allows mitigation of the impacts caused during construction and operation, via removal of land use restrictions. Therefore, there are no identified impacts during this phase.

5.8.3 Mitigation Measures

Direct loss of land

The land take at the plant site and at each of the transmission line tower sites is fixed by the basic design requirements of the power project. Therefore there is no specific mitigation measures in relation to restricting the area of permanent land take by the project. However, the transmission line route and the siting of the plant site has been undertaken to avoid existing properties, to minimise the overall impact.

During final siting of the transmission line towers existing land uses will be taken into account to reduce impacts.

At decommissioning, the majority of land will return to its current, or suitable alternative, land use and therefore reverse the construction and operational impacts.

Land use change

During construction, the area of land to be occupied for the project will be minimised by careful planning of access routes to each transmission line tower construction site and by educating workers to be aware of cropping areas so controlling the total area of disturbance. This requires good on-site management to ensure that trucks and other vehicles are not indiscriminately driven around site and materials are held in single locations and not spread about. This will be managed and enforced through an Environmental Management Plan.

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The compensation assessment for people who are affected draws on the area of affected land and land/crop value. The findings are presented in the Census Commission Report December 2007, see Section 6.3.

5.8.4 Evaluation of Mitigated Impact

Direct loss of land

Construction / Operation

There are no impacts on direct loss of land arising from the decommissioning phase. Therefore impacts relate only to construction/operation.

The total, temporary, direct land loss (for the 15 month construction period) and permanent direct loss of land to this project are approximately 13.82ha (7.7ha plant site and construction compound, 0.72ha access road, 0.38ha tower bases) and 8.8ha (4ha operational area, 0.72ha access road, 0.38 tower bases) respectively. On the basis of the overall land use within the area (see Section 5.8.1), this would split into approximately 30% loss of subsistence agriculture, 52% bush/scrub and 16% concessions along the way leave and loss of predominately agricultural areas at the project site.

The main soil types of this region are intensively weathered, nutrient poor, low pH and of limited agricultural capability (see Section 5.11). This has resulted in mainly subsistence farming and shifting agriculture to allow soils to recover following a period of cropping. Survey data on land use supports this status.

Land availability is not a limiting factor in the region as population densities are low and the region does not have large-scale agriculture. Therefore, the small scale loss of land use to this development will not result in a significant impact on the overall land resources within the district. However where farm land is taken then the livelihood of the local population may be affected. This impact is assessed as part of the socio-economic studies (see Section 6.3).

Due to the poor soils for permanent agricultural uses, the low land use capability of the affected area and the small-scale overall permanent loss of land, impacts from the direct loss of land use are assessed as insignificant.

Land use change

Construction / Operation

Approximately 5.4ha of land within the wayleave and 7.7ha within the plant site will be subject to land use change. As most of the vegetation within the wayleave area is bush/scrub the principal impacts of wayleave clearance will be on the flora and fauna of the district. This is assessed within the Ecology section, 5.9.

Within the remainder of the wayleave and most of the plant site areas, the main impact is on subsistence farming communities. In terms of impacts on farming the loss of potential revenue and the need to relocate land are discussed within the social impact assessment (see Section 6.3).

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The loss of agricultural land within the project area is small and the availability of alternative areas for agricultural uses in the surrounding area is large. Therefore, the overall impact of wayleave and plant site / construction compound clearance is defined as insignificant.

5.8.5 Evaluation of alternative development options

The adoption of any of the proposed project alternatives would not significantly alter or minimise the overall impacts on land use of the proposed development.

The zero (no project) option would remove the potentially negative impacts that may arise from the construction and operation of the project, however during the environmental assessment of the project no significant impacts on land use have been identified.

5.8.6 Conclusions

There are no predicted significant impacts on land use arising from this project. Overall land take for the plant site and transmission line is low and the impacts identified have been mitigated, also see Section 6. A summary of the impacts is set out in Table 5.8.2.

Table 5.8.2: Summary of Impact Evaluation – Land use							
Project Location	Phase ²	Impact	Nature of Impact	Receptor	Nature ¹	Duration ¹	Significance ¹
Plant site	C/O	Land take	Construction of the plant site	Land use and soils	Adverse	Long-term	Insignificant
Transmission line	C/O	Land take	Construction of towers	Land use and soils	Adverse	Long-term	Insignificant
	C/O	Land use	Change of land use in wayleave	Scrub/bush areas, farm land	Adverse	Long-term	Insignificant
1 – see Table 1.5.1 for definition							
2 – Phase - C = Construction / O = Operation / D = Decommissioning.							

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5.9 ECOLOGY

5.9.1 Baseline Conditions

General Setting - Coastal Belt

The Dibamba Power Project is located in the Littoral district of the Nigero-Camerouno-Gaboneese, Evergreen Forest Sector (Letouzey, 1985). The sector lies as an arc around the Bay of Biafra. Floristically, this forest is known to be part of one of the most species-rich areas in Africa and therefore is very important for conservation (Tchouto, 2004). The sector is unique in the world, hosting species of high conservation priorities (e.g. endemic, rare, new and threatened plant species).

The remaining forest in the region has been studied by many authors and in various aspects. Recent intensive botanical and ecological surveys have been undertaken within the coastal forests, such as within the Campo Ma'an National Park. Tchouto (2004) recorded 114 endemic species, 29 of which are only known from this area. The National Park is also known for its rich fauna, with four endemic fish species and 2 endemic bat species (Vivien, 1991). The explanation for this high incidence of endemism and richness stems partly from the fact that the sector is close to the series of rain forest refuge areas in Central and West Africa (Hamilton, 1982; Maley 1987; Sosef 1994; Achoundong 1996, 2000) and is within an area of high humidity with approximately 4,000mm of rain per annum.

The coastal section of the district is a vulnerable ecosystem due to its limited area and ease of access. From north to south the coastal forest extends from Nigeria to Gabon. From west to east the width rarely exceeds 150km. However, the first roads in this region were built along this belt and in the century since the road building started, a large proportion of the suitable land along the road network has been disturbed (Dames and Moore, 1999). This easy accessibility has resulted in intense human pressure on the habitat and the natural vegetation has been heavily disturbed by human management (economic investment, farm and industrial plantation) including the general vicinity of the project area where no forest remains. The closest forest fragment to the project area is approximately 1km to the south-west, although whether this is particularly extensive is unclear.

General Setting – Project Area

The plant site and the associated transmission line corridor are both situated within highly disturbed agricultural, fallow and scrub habitats along the corridor of the Douala-Edéa road about 2km west of the Dibamba River. To confirm the status of the project area, particularly in relation to any relict forest species that might be present, baseline ecological surveys were undertaken in September 2007.

Protected Areas

There are no protected areas close to the Dibamba Power Plant site and the new transmission line corridor. The closest existing protected area is the Douala-Edéa Faunal Reserve, located approximately 35km to the south at its point of closest approach. Although it will not be impacted by the project, a short summary of the most important elements of the reserve is provided below to provide context.

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Ecosystems	Flora	Fauna
Mangrove	Rhizophora (mangrove)	Forest elephant
Swamps/Marshes	Avicennia	Drill
Alternative Atlantic forests	Nypa Palms	Chimpanzee
Secondary Forests	Many tree species	Situtunga
Plantations	Commercial Species	Grey Parrot

In addition, a small proposed protected area known as the Bois de Singe is present between Douala Airport and the nearby coast, approximately 10km from the project area. The forest fragment is relatively isolated and degraded (*pers comm*, Ebia Ndongo Samuel, Ministry of Forests and Wildlife) and a recent proposal has been made to develop it as an arboretum.

Project Area – Flora

Method

In order to display the characteristic of vegetation and species within the Dibamba Power Plant site, a rapid botanical survey (RBS) was undertaken of the site by a Safex Botanist in 2007 including a walkover of the proposed powerline route.

The majority of species encountered within the site were identified in the field. To complement the survey however, botanical collections were made for identification at the National Herbarium. During this collection, emphasis was given to shrubs and herbaceous species.

Baseline

The plant site covers an area of 7.7ha consisting of agricultural plantings, old fallow, and regenerating secondary scrub, but no true forest or trees of significant size. Fallow areas are generally covered with pioneer vegetation and have a low conservation value. Sensitive plants have generally been destroyed by slash and burn agricultural systems.

The vegetation is dominated by pioneers, which are ephemeral herbs and shrubs with rapid growth and that actively colonise open places. Despite its great exuberance, this ephemeral vegetation is soon replaced by trees of greater longevity through the process of succession.

Based on the physiognomy, the RBS allowed recognition of two sub-types of fallows within the Dibamba project site. Close to the soap factory there is an area mostly covered by herbs and very sporadic small shrubs. At this part of the site maize had been cultivated in 2007. At the opposite corner of the site and along the route of the proposed transmission line, the fallow is shrubbier with several young trees. Amongst those young trees, perennial crops like Yams, Macabo, Manioc, Pineapple, Sugar Cane are grown by the local farmers.

Despite of this physiognomic difference, the flora is similar. The two sub-types of fallows are covered with herbaceous and shrubby pioneers. Herbs are the most important component of the vegetation. At least 40 species of herbs have been recorded (see Appendix J). The most common and abundant herbs species are: *Chromoleana odorata*, *Aspilia africana*, *Ageratum conizoies*, *Desmodium adscendens*, *Haumania danckelmanniana*.

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Shrubs are an important characteristic of the physiognomy. A total of 18 species of shrub have been recorded (Appendix J). The most common are *Alchornea cordifolia*, *Baphia nitida*, *Rauvolfia vomitoria*, *Albizia zygia*, *Albizia athianthifolia*.

Very rare small forest relic trees have survived from destruction for agriculture. The largest of these relicts within the development site is *Sterculia tragacanta*, with a diameter up to 20cm. Other forest relic trees are: *Pseudospondias microcarpa*, *Spathodea campanulata*., *Pycnanthus angolensis*, *Anthonotha macrophylla* and *Desbordesia glaucescens*.

In consultation with the local population no sacred trees have been identified within the project area, see Section 6.3.

Floral diversity

The number of species within the site has been determined using the RBS and the plant collection. A total of 81 species have been recorded within the site (Appendix J). Those species recorded are mainly pioneers and the most important factor regulating their distribution is the quantity of light. These species generally have very large distribution in Africa. No endemic or sub-endemic species were recorded in the project area.

Conservation potential

The conservation potential (flora) is evaluated with International Union for the Conservation of Nature & Natural Resources (IUCN) categories: I'UICN (2001), version 3.1:

- Critically endangered (CR) : 0
- Endangered species (EN) : 0
- Vulnerable species (VU) : 4 species

The four vulnerable species are *Rauvolfia vomitoria*, *Pentadiplandra brazzeana*, *Senna alata* and *Alstonia boonei* and all are medicinal plants, which is the cause of their vulnerability. Despite the IUCN classification, the risk to these four species is relatively modest as they are all widespread in the Lower Guinea forest.

In summary, just four out of 81 species (representing 4.9 %) are vulnerable with moderate risk and there are very few species of important conservation value within the project site.

Crops

There are some crops within the site and along the powerline transmission route, these being Pineapple, Avocado, Papaw, Palm Oil, Macabo, Manioc, Potato, Yam, Dolè, Groundnut, Banana and Plantain.

Medicinal Plants

Despite the deep degradation of vegetation, four important medicinal plants survive in the project site and three of them are used in industry. They are *Pentadiplandra brazzeana* (Photo 5.9.1), *Senna alata*, *Rauvolfia vomitoria* (Photo 5.9.2). The fourth species *Alstonia boonei* is traditionally used to cure malaria.

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Conclusion

Except forest relic trees, all the species cited here are quite common in newly disturbed forest in southern and coastal Cameroon. They actively colonise opened areas in forests and some of them have the behaviour of invasive species, including *Chromoleana odorata*, *Ageratum conizoides* and *Aspilia africana*,

The conservation value of this vegetation is very low as demonstrated by the low number of bio-indicators of important value (species of important conservation value and IUCN vulnerable species). None of the species recorded require special protection.

Project Area – Fauna

Method

Birds were recorded during site surveys on 19th (1300-1430hrs), 20th September (0630-0845 hrs, 1600-1800 hrs) and 21st September (0630-0915 hrs). Birds were detected by sight and sound whilst slowly walking the study area using the extensive network of public tracks and roads. The study area was a 0.5km radius around the centre of the plant site but extended to include the transmission line wayleave. Birds were observed through 8x32 binoculars and a 20-60 x 80mm tripod-mounted telescope.

Baseline

A total of 47 bird species were recorded during the survey (see Table 5.9.2), including three Palearctic migrants namely European Bee-eater (*Merops apiaster*), Barn Swallow (*Hirundo rustica*) and Spotted Flycatcher (*Muscicapa striata*). A greater number of such migrant species would be expected if the survey had been undertaken during October-March. Of the remaining 45 species, almost all are resident, with the possible exception of the African Crane (*Crecopsis egregia*) which may be an intra-African migrant in this location.

Almost all of the species recorded are characteristic of agricultural areas or secondary growth, not unsurprisingly given that the site is relatively remote from remaining forest fragments (closest forest fragment is about 1km south-west) The only hornbills recorded were in or close to these fragments, viewed from the study area. The presence of good numbers of Grey Parrots (*Psittacus erithacus*), a forest species, commuting overhead, suggests that there are relatively extensive forest fragments not too remote from the development site.

No mammals were recorded during the survey, and the mammal community is likely to be restricted to small rodents. This is further substantiated through the household surveys (Scott Wilson, November 2007) of affected persons, undertaken for the SIA, which identified a very small proportion of households (3 of 38) who hunted in the area for fish and hare.

Table 5.9.2: Bird Species Recorded in the Study Area

Latin Name	English Name	Observations
1. <i>Milvus migrans</i>	Yellow-billed (Black) Kite	Several sightings over surveys/study area
2. <i>Kaupifalco monogrammicus</i>	Lizard Buzzard	1 seen
3. <i>Accipiter melanoleucus</i>	Great Sparrowhawk	1 seen
4. <i>Pternistes squamatus</i>	Scaly Francolin	Heard occasionally, presumably several pairs in wider area
5. <i>Crecopsis egregia</i>	African Crane	Total of 4 seen along trackways

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Table 5.9.2: Bird Species Recorded in the Study Area		
Latin Name	English Name	Observations
6. <i>Streptopelia semitorquata</i>	Red-eyed Dove	Common
7. <i>Treron calvus</i>	African Green Pigeon	Flocks of 10 and 30 flew through
8. <i>Turtur afer</i>	Blue-spotted Wood-dove	Several pairs seen
9. <i>Psittacus erithacus</i>	Grey Parrot	Flocks of up ten seen regularly presumably commuting between more extensively forested areas
10. <i>Chrysococcyx caprius</i>	Diderick Cuckoo	Frequently heard, at least 6 seen and probably fairly common
11. <i>Centropus monachus</i>	Blue-headed Coucal	Frequently heard, several pairs seen
12. <i>Cypsiurus parvus</i>	African Palm Swift	Common
13. <i>Apus affinis</i>	Little Swift	Large colony at Dibamba River bridge, small numbers over site
14. <i>Ispadina picta</i>	African Pygmy-kingfisher	5 sightings, probably fairly common
15. <i>Halcyon senegalensis</i>	Woodland Kingfisher	Fairly common
16. <i>Merops pusillus</i>	Little Bee-eater	Small numbers
17. <i>Merops apiaster</i>	European Bee-eater	Frequently seen high over site
18. <i>Bycanistes fistulator</i>	Piping Hornbill	Up to 6 seen perched distantly in forest fragment to south, several in scattered trees closer to site.
19. <i>Pogoniulus bilineatus</i>	Yellow-rumped Tinkerbird	1 seen
20. <i>Pogoniulus scolopaceus</i>	Speckled Tinkerbird	1 group of 3 in small fruiting tree
21. <i>Lybius vieilloti</i>	Vieillot's Barbet	1 seen close to the above
22. <i>Dendropicos fuscescens</i>	Cardinal Woodpecker	1 male seen
23. <i>Hirundo rustica</i>	Barn Swallow	Small numbers
24. <i>Hirundo semirufa</i>	Red-breasted Swallow	1 pair seen
25. <i>Hirundo preussi</i>	Preuss's Cliff-swallow	Small numbers frequently over site
26. <i>Anthus pallidiventris</i>	Long-legged Pipit	1-2 seen along tracks
27. <i>Corvus albus</i>	Pied Crow	Small numbers
28. <i>Pycnonotus barbatus</i>	Common Bulbul	Common
29. <i>Andropadus virens</i>	Little Greenbul	2 seen
30. <i>Chlorocichla simplex</i>	Simple Greenbul	Common but elusive in thicker scrub
31. <i>Turdus pelios</i>	African Thrush	Fairly common, several juveniles seen
32. <i>Cisticola anonymus</i>	Chattering Cisticola	Fairly common in rank grassland areas
33. <i>Schistolais leucopogon</i>	White-chinned Prinia	Several small groups seen in scrub areas
34. <i>Sylvietta virens</i>	Green Crombec	3 seen and others heard, probably fairly common
35. <i>Camaroptera brevicaudata</i>	Grey-backed Camaroptera	Common
36. <i>Muscicapa striata</i>	Spotted Flycatcher	1 migrant seen
37. <i>Platysteira cyanea</i>	Brown-throated Wattle-eye	2 pairs seen
38. <i>Hiedydipna collaris</i>	Collared Sunbird	Small numbers
39. <i>Cinnyris chloropygius</i>	Olive-bellied Sunbird	Common
40. <i>Passer griseus</i>	Northern Grey-headed Sparrow	Common
41. <i>Ploceus nigricollis</i>	Black-necked Weaver	1 seen
42. <i>Ploceus cucullatus</i>	Village Weaver	Abundant, with over 500 seen at roost
43. <i>Ploceus nigerrimus</i>	Veillot's Black Weaver	Small numbers with the above
44. <i>Spermestes cucullata</i>	Bronze Mannikin	Small numbers in seeding grass
45. <i>Spermestes bicolor</i>	Black-and-white Mannikin	Fairly common, more common than S.

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Table 5.9.2: Bird Species Recorded in the Study Area		
Latin Name	English Name	Observations
		<i>cucullata</i>
46. <i>Estrilda melpoda</i>	Orange-cheeked Waxbill	Fairly common
47. <i>Vidua macroura</i>	Pin-tailed Whydah	Small numbers and probably fairly common

Diversity

The bird species recorded during the survey are mainly characteristic of agricultural areas and secondary growth, and are common and widespread both locally and in West Africa. It is clear that some forest birds (e.g. hornbills, grey parrots) range from adjacent forest fragments into and over the project site area to feed but given their cavity nesting habits, these species will be confined to forest areas for breeding. The bird diversity of the study area and the site is therefore judged to be low.

Conservation Potential

The only bird species of conservation concern recorded during the surveys is the grey parrot (*Psittacus erithacus*) which is listed by the IUCN as Vulnerable (see Appendix J). As noted above, this species is assumed to nest in surrounding forest fragments but is normally intensively trapped for the caged bird trade. No parrots were seen feeding within the site and the site is therefore judged to be of negligible importance for this species.

Conclusion

Except for the grey parrot, all the species cited here are quite common in newly disturbed forest in southern and coastal Cameroon. Almost all of the birds recorded actively colonise opened areas in forests, secondary growth and agricultural areas.

The conservation value of this bird community is low as demonstrated by the low number of rarer species. None of the species recorded require special protection or mitigation during the development.

5.9.2 Potential Impacts

The development of the Dibamba Power Project will require land take for the construction site and vegetation clearance and on-going vegetation management within the transmission line corridor. These requirements have the potential to cause a series of impacts on the flora and fauna of the area. These are summarised as follows:

- Permanent loss of existing habitats and related biodiversity due to land clearance for construction;
- Loss or alteration of habitat types due to clearance for the transmission line wayleave;
- Habitat severance due to clearance of the 30m wayleave; and
- Disturbance of wildlife and potential increase in road kills, due to project construction and operation activities.

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Loss of habitats

Construction and operation

The construction activity for the Dibamba power project will require a permanent land take at the plant site of 7.7ha and an additional relatively small landtake at the base of each pylon for tower construction (25m³), along the transmission line corridor. The area to be cleared during the construction phase for the establishment of a construction compound, is included within the site area (Figure 3.3.1).

Within the development area the existing habitats and any associated biodiversity and species will be lost. In the case of the construction compound this will be allowed to revegetate following completion of the construction works. However, this area will be lost for approximately 15 months and may not regain its former habitat type. Therefore, for the purposes of the assessment this area is also assumed to be total loss of habitat.

Decommissioning

At decommissioning, the potential exists for land taken for the development to be cleared of all construction and the vegetation cover allowed to regenerate naturally. However, in terms of regeneration of the secondary forest habitats, which are of most value, this would be a very long process. Decisions on the nature of the closure works cannot be defined until nearer the time of decommissioning and therefore the potential habitat regeneration cannot be defined at this point. It is likely that the site would be returned to agricultural use.

Alteration of habitat

Construction and operation

Along the wayleave for the transmission line the vegetation will need to be cleared at construction and then managed during the operational phase to ensure vegetation height does not exceed 2m. This will therefore significantly alter any existing trees and scrub patches. In addition, any tall trees (>15m) on the edge of the wayleave will also need to be cleared. The total area of land within which the vegetation will be managed is 5.4ha.

Decommissioning

At decommissioning, the power line will be removed and the vegetation allowed to grow back to full height, unless alternative land uses are proposed. If regrowth of the vegetation is permitted then following decommissioning the former habitats can regenerate. Decisions on the nature of the closure works cannot be defined until nearer the time of decommissioning. It is likely that it would be returned to agricultural use.

Habitat severance

All phases

The clearance of a 30m wide corridor of all tall vegetation can lead to habitats being bisected and passage across the wayleave restricted. However, within the context of the Dibamba Power Project area, this potential impact is deemed insignificant.

The wayleave corridor traverses predominantly agricultural land with some old fallow and scrub. The overall loss of forest, the subsequent cultivation and the existing road have therefore caused a major severance between remaining forest patches.

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Disturbance of wildlife

Construction

During the construction phase, the physical activity on both the transmission line and plant sites will create noise and general disturbance which has the potential to disturb local fauna. This may lead to animals leaving an area. In addition construction traffic on roads has the potential to increase the risk of road kills for any animal crossing the transport routes. Given the mammal population is generally restricted to small rodents, the impacts are judged to be negligible.

Operation

During operation, there will be no significant increase in traffic on the road network and no regular activity along the transmission line corridor. Potential impacts therefore relate only to the plant site.

At the plant site, the main disturbance will be from noise generated by the power plant itself. Traffic will enter the site each day but volumes will be low and maintenance and operational activity will be undertaken, but again these are relatively minor in terms of potential impacts on wildlife, particularly in view of the adjacent soap factory as an existing noise source.

Decommissioning

Decommissioning activity has the potential to have similar impacts to those from the construction activity. However, as decisions on the nature of the closure works cannot be defined until nearer the time of decommissioning the actual level of activity and traffic generation cannot be defined.

5.9.3 Mitigation Measures

The only potential impacts that may arise from the proposed Dibamba Power Project relate to the loss or alteration of habitats and disturbance to wildlife. The principal measures for the mitigation of these impacts are as follows:

Loss of habitats

- Minimise the area of land take during the design process; and
- Locate project elements within already disturbed areas such as use of existing road and transmission line corridor.

Alteration of habitat

- Management of the vegetation within the transmission line corridor to maintain the maximum cover permissible (up to 2m); and
- As for habitat loss, locating project elements within already disturbed areas such as use of the existing road and transmission line corridor will reduce the area of good habitat affected, and enabling revegetation post-construction where possible.

Disturbance of wildlife

- Control of noise and areas of operation as far as is practically possible; and Control of vehicle traffic speeds.

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5.9.4 Evaluation of Mitigated Impact

Loss of habitats

Construction and operation

The total loss of habitat, i.e. land cleared for construction of the plant site (including the construction compound) and the transmission line towers, equates to approximately 7.7 ha and tower bases, of cultivations, old fallow and secondary growth, in total.

In addition, the project area is located along the existing main road network and close to existing power lines. The presence of this road and the villages along it have resulted in significant degradation of the original forest habitats such that most has been cleared. Although a few species of conservation importance were identified during the baseline survey, overall, the conservation value of the area affected is assessed as low.

This combination of a relatively small area of loss, the low conservation value of the areas affected and the extensive forest habitat within this part of Cameroon, particularly to the east, result in an assessment of the impacts of the loss of habitat as being adverse long term, but minor in significance.

Decommissioning

At decommissioning, assuming all areas are cleared of built development and the land restored to its former use, then the loss of habitat can be reversed. However, this would be a long term process and impacts cannot be evaluated until decisions on final land use are made. However this phase has the potential to provide partial mitigation to the impacts of the former phases. Restoration to agricultural use is much more likely than restoration to a forested habitat.

Alteration of habitat

Construction and operation

The alteration of habitat relates entirely to the clearance of vegetation within the 30m wayleave for the transmission line. Within this zone, all vegetation has to be managed to ensure it does not exceed 2m in height. Therefore, any existing trees and scrub will be removed and the habitat effectively lost.

The total area affected area requiring clearance will be between approximately 13.1ha. As the overall conservation value of the habitats within the project area and the extensive forest that exists within this part of Cameroon is defined as low, the overall impacts is assessed as adverse long term, but minor in significance.

Decommissioning

At decommissioning, assuming all areas are cleared of built development and the land restored to its former use, then the loss of habitat could be reversed. However, this would be a long term process and impacts cannot be evaluated until decisions on final land use are made. It is likely that the area would be returned to the existing predominantly agricultural use.

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Disturbance of wildlife

Construction

The potential for disturbance of wildlife and risk of road kills relates to two main factors: first the degree of additional activity that will be introduced by the proposed development and second the presence of faunal species within the area that may be affected.

For the construction phase, the works will affect the areas of both the plant site and the transmission line. At the plant site, significant activity will be undertaken for the full 15 month construction phase. However, works on the transmission line will move from area to area as sections of the line are complete. Therefore, the duration of disturbance at any one location will be short. In addition to the general construction activity, additional traffic on the Douala-Edéa road, up to 10% increase at peak period, will create a greater risk of road kill. Significant new activity, and therefore potential for disturbance to wildlife, will therefore be introduced during the construction phase.

However, the faunal species in the area do not include any large mammals and the highly degraded nature of the habitats, with just a few scattered forest fragments in an extensive agricultural mosaic, the existing traffic and the relatively short period of the construction phase act to reduce the significance of these impacts. During the baseline transmission line survey, no particularly endangered or protected animal species, with the exception of grey parrot, were identified.

The overall impacts from this phase of the operation are therefore assessed as adverse short term, and minor in significance.

Operation

The impacts from the operational phase relate only to the noise and periodic maintenance activity at the plant site. No regular works are conducted along the transmission line that would have any major impacts on wildlife.

The power plant will generate elevated noise within the habitats surrounding the plant site during the operational phase although the existing soap factory is an existing source of noise impact. The new noise impacts arising from the plant does however have the potential to impact on the existing wildlife. However, the noise will tend to be continuous in nature rather than with fluctuations in both volume and character. Constant noise generation has less impact on wildlife than highly variable noise sources.

As noted within the baseline section, the faunal diversity of the area is low and no protected species or particularly sensitive species were identified within the survey. As such the impact on faunal species during the operational phase is assessed as adverse long term, but insignificant in nature.

Decommissioning

During the actual decommissioning activity the disturbance cause by noise etc. will be similar to that of the construction phase. Once decommissioning is complete, all disturbance from the power project will be removed and no further impacts will arise.

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5.9.5 Evaluation of Alternative Development Options

None of the project alternatives has a significant effect on the overall potential impacts on the flora and fauna of the area arising from the proposed development.

The zero (no project) option would remove the potentially negative impacts that may arise from the construction and operation of the project. However no significant impacts have been identified.

5.9.6 Conclusions

The flora and fauna assessment for these studies have identified the habitats within the project area to be either subsistence agricultural areas, old fallow or secondary scrub. The access into the area created by the Douala-Edéa road, the presence of local villages and the extensive clearance for agriculture have all contributed to this degradation. The overall conservation status of the areas, for both flora and fauna, is therefore low.

Whilst the development will result in the loss and alteration of this habitat, and has the potential to cause disturbance to wildlife, the overall area of impact is relatively low and due to the current level of disturbance within the area, overall impacts are minor.

Table 5.9.3: Summary of Impact Evaluation – Ecology

Project Location	Phase ²	Impact	Nature of Impact	Receptor	Nature ¹	Duration ¹	Significance ¹
Plant site	C/O/D	Loss of habitats	Industrial feature in natural setting	Flora and fauna	Adverse	Long-term	Minor
	C/O/D	Alteration of habitats	Industrial feature in natural setting	Flora and fauna	Adverse	Long-term	Minor
	C/O/D	Habitat severance	Industrial feature in natural setting	Fauna	Adverse	Long-term	Minor
	C/D	Disturbance of wildlife	Industrial feature in natural setting	Fauna	Adverse	Long-term	Minor
Transmission line	C/O/D	Loss of habitats	Additional power line	Flora and fauna	Adverse	Long-term	Minor
	C/O/D	Alteration of habitats	Additional power line	Flora and fauna	Adverse	Long-term	Minor
	C/O/D	Habitat severance	Additional power line	Fauna	Adverse	Long-term	Minor
	C/D	Disturbance of wildlife	Additional power line	Fauna	Adverse	Long-term	Minor

1 – See Table 1.5.1 for definition

2 – Phase - C = Construction / O = Operation / D = Decommissioning.

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5.10 CULTURAL HERITAGE

This chapter considers cultural heritage and archaeology in respect of the proposed Dibamba project.

Cultural Heritage, in accordance with IFC Performance Standard 8 (PS8), includes “tangible forms of cultural heritage, such as tangible property, and sites having archaeological (prehistoric), palaeontological, historical, cultural, artistic, and religious values, as well as unique natural environmental features that embody cultural values, such as sacred groves, [...] whether or not it has been legally protected or previously disturbed”¹. PS8 also defines “critical cultural heritage” as consisting of internationally recognised heritage and/or legally protected cultural heritage areas.

This section provides a summary of the archaeological potential and an assessment of the cultural heritage interest of the project area. The baseline information available for this section was obtained in the following ways:

A three-day site survey commissioned by AES Sonel aimed at estimating the archaeological potential of the areas concerned by the project², in accordance with IFC Guidance Note 8 (the full survey report is provided in Appendix K); the survey involved observation of both open sites and geotechnical borehole samples on the plant site (the transmission line route has not been surveyed).

A socio-economic survey undertaken as part of the Social Impact Assessment (SIA), where qualitative and quantitative information was gathered on, *inter alia*, the number and location of any sites of cultural and/or spiritual significance (such as churches or graves), see Section 6.

5.10.1 Baseline Conditions

Site Description

The project area is a recognised archaeological area in the Douala region and is known to contain several archaeological human settlements. The survey identified three zones containing archaeological remains as illustrated in Figure 5.10.1.

Zone 1 is situated on the present access track to the plant site. The track is 8m wide and runs from the main Douala-Edéa road up to the site. The zone where the findings were made stretches for about 100m and corresponds to a combination of ferrier (concentration of iron scoria) for more than 20m, this may date to the Iron Age; and pottery, pipe, iron ore, burnt palm nut, charcoal, bluish beads and turned pottery fragments. The latter two items are likely to be pre-colonial. Other pottery fragments found in zone 1 may date back to the Neolithic. The total surface area containing archaeological remains cannot be confirmed at present.

Zone 2 is situated east of zone 1. This zone is predominantly fallow land on which fragments of decorated and undecorated ceramic pottery (which may date back to the Iron

¹ International Finance Corporation (2006) Policy and Performance Standards on Social and Environmental Sustainability – Performance Standard 8: Cultural Heritage.

² Oslisly, R. (2007) Rapport d'Évaluation du Potentiel Archéologique des Futurs Sites à Centrale Thermique de Dibamba (Douala) et Mpolongwé.

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Age) can be found on the surface, in varying conditions (from well preserved to very eroded). Soil visibility in this zone is about 5% and the soil has been highly altered by the population that have grown crops in the zone. Nevertheless the existence of archaeological sites under the humid layer was confirmed by examination of a geotechnical core sample which showed pottery fragments (which may date back to the Neolithic) at approximately 150cm depth.

Zone 3 – the container zone – is contiguous to the plant site and borders its eastern boundary. The site shows traces of pits containing ceramics.

Archaeological Potential

The survey has identified the potential for significant remains at the abovementioned sites, dating from the prehistoric period. In particular, the presence of ceramics buried up to 1.50m below ground level may indicate an early settlement buried at the site. It is not known at present whether the remains are likely to be of local, regional, or national value.

Sites of Cultural and/or Spiritual Significance

In consultation with the local population, see Section 6.3, no sites of cultural and/or spiritual significance, including graves and sacred trees, were identified on or in the immediate vicinity of the site.

There are no national legally protected cultural heritage areas/buildings on the site and in the surrounding areas.

5.10.2 Potential Environmental Impacts

The survey undertaken shows that there is the potential for significant remains (dating to the prehistoric period) to be present on the plant site. In particular, where archaeological deposits survive below ground level within the current site their condition is likely to be good.

Construction

New infrastructure constructed on current open spaces on the operational area of the plant site is likely to have a permanent impact on any existing archaeological deposits, the significance of which will be dependant on the archaeological value of the underlying deposits.

Excavation works during installation of the transmission line are likely to have an impact on any surface or below ground archaeological deposits.

Construction of the transmission line tower foundations will impact a very limited area of approximately 25m² at each tower location (maximum 15 towers), totalling 0.04ha, at this scale minimal impacts will occur and therefore is not considered further.

Operation

No impacts will occur during operation.

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Decommissioning

Any impacts resulting from the construction of the proposed power plant will remain even if structures are removed during decommissioning.

5.10.3 Mitigation and Monitoring

The survey undertaken has provided a baseline level of information with respect to archaeology on the plant site. The finds appear not to fall into the “critical category” as defined by IFC Guidance Note 8, paragraph 8³, and therefore there is no suggestion that the project should be moved or altered. However, working areas should be minimised wherever possible.

Nevertheless, it must be noted that:

- The finds have been identified as potentially being of significant importance in the regional context; and
- Most of the actual site area has not been surveyed at present, and the available results were extrapolated to indicate a general high potential for significant archaeological remains to be located within the boundaries of the operational area of the plant site.

It is therefore recommended, in the absence of national legislation regarding archaeological protection or investigation, that further investigation be undertaken in line with IFC Guidance Note 8, paragraph 7, in order to identify/confirm the presence of any archaeological deposits of regional or higher importance.

IFC Guidance Note 8, paragraph 7

Removal of Cultural Heritage: Most cultural heritage is best protected by preservation in its place, since removal is likely to result in irreparable damage or destruction of the cultural heritage. The client will not remove any cultural heritage, unless the following conditions are met:

There are no technically or financially feasible alternatives to removal.

The overall benefits of the project outweigh the anticipated cultural heritage loss from removal.

Any removal of cultural heritage is conducted by the best available technique.

Any investigation work should be flexible enough to be programmed commensurate with the development of the plant site and should not affect the successful progress of the project.

³ IFC Guidance Note 8 (2007) defines critical heritage as consisting of “(i) the internationally recognized heritage of communities who use, or have used within living memory the cultural heritage for longstanding cultural purposes; and (ii) legally protected cultural heritage areas, including those proposed by host governments for such designation”. IFC Guidance Note 8 available in [[http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/pol_GuidanceNote2007_8/\\$FILE/2007+Updated+Guidance+Note_8.pdf](http://www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/pol_GuidanceNote2007_8/$FILE/2007+Updated+Guidance+Note_8.pdf)].

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The following steps are therefore recommended:

- After site clearance, undertake archaeological transect survey; if the survey is positive, the scope for evaluation trial excavations should be defined on the most important locations; and
- Undertake further surveying of the site in order to confirm the presence or absence of regionally and/or nationally important deposits; this should include both surface prospecting and intrusive research (i.e. analysis of core samples), where necessary.

Appropriate monitoring should be included throughout both the survey and construction works (i.e. presence of archaeology specialist).

Following evaluation, mitigation schemes comprising either preservation in-situ or preservation by record or a combination of the two will reduce the overall significance of the impact.

5.10.4 Evaluation of Mitigated Impacts

The construction of the structures within the operational area of the plant site (4ha) and access road (0.72ha) will be limited to areas requiring extraction, foundations and levelling. Where excavation and levelling of the plant site is required, mitigation in the form of site walkovers and archaeological monitoring of the works during construction will enable the appropriate mitigation to be enacted in line with internationally recognised methods. Mitigated impacts will be long term, adverse but insignificant.

5.10.5 Evaluation of Alternative Development Options

The no-project alternative would cancel any potentially significant adverse impacts arising from the construction and operation of the project. However no major significant impacts have been identified at this stage.

5.10.6 Conclusions

The survey has identified the potential for significant remains at the identified archaeological zone dating from the prehistoric period (in particular, the presence of ceramics below ground level) which may indicate an early settlement buried at the site. It is not known at present whether the remains are likely to be of local, regional, or national value.

In order to confirm the presence or absence of deposits of regional or higher archaeological value, further monitoring surveys should be undertaken to confirm the presence of such deposits. It is considered that further investigation works can be undertaken in parallel with commencement of works provided appropriate on-site best practice measures are implemented.

If any deposits of regional or higher significance are found, appropriate mitigation and consultation measures should be put in place in line with IFC PS8 and IFC Guidance Note 8.

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Table 5.10.1: Summary of Impact Evaluation – Cultural Heritage							
Project Location	Phase ²	Impact	Nature of Impact	Receptor	Nature ¹	Duration ¹	Significance ¹
Plant site	C	Levelling / Excavation	Construction of the plant site	Archaeological remains	Adverse	Long-term	Insignificant
1 – see Table 1.5.1 for definition							
2 – Phase - C = Construction / O = Operation / D = Decommissioning.							

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5.11 GEOLOGY AND SOIL

5.11.1 Baseline Conditions

Soils

The baseline conditions within the project area were established by reference to published materials (Bernard, Yerima and Van Ransy, 2005). Additional information on site-specific sub-surface ground conditions for the project area was obtained from the geotechnical investigation undertaken on behalf of AES Sonel.

The project area is located approximately 20km east of Douala within the village of Yassa in the Douala III District of Wouri Division, Littoral Province Cameroon. The published data indicates that the entire project area is classified as being within the Haplic Ferralsols soil group associated with humic gley soils.

The ferralsols are deep intensively weathered materials with sandy surface horizons becoming more clayey with depth. These soils are physically stable and well structured giving good drainage characteristics with relatively high permeabilities. Chemically the soils are poor with generally low pH values, poor nutrient status and low cation exchange capacities. Nutrients are therefore easily leached from these soils. Iron and aluminium oxides concentrations exist leading to the yellowish or reddish soils colours. Due to the poor nutrient status, soils tend to be used for shifting agricultural uses and need artificial fertiliser if permanent farming is to be practised. Land use capability is therefore low. Gley is the secondary soil group in the project area, but is limited in its extent.

Site Geology

At depth the site is underlain by undifferentiated gneisses and migmatites of the Precambrian age. Cretaceous sediments of marine origin followed by Tertiary and recent deposits overlie the Precambrian bedrock within the project area.

Geotechnical Investigation

A geotechnical survey was undertaken at the plant site between October and November 2007. The purpose of the investigation was to assess the sub-surface conditions, and the engineering properties of the rocks and soils for the proposed structures.

A total of 27 boreholes and trial pits were put down across the plant site. Standard penetration tests were undertaken every 1m within seventeen of these holes and soil samples were obtained for laboratory testing. Boreholes / trial pits were placed on various parts of the project area including:

- Access road;
- Fuel-oil storage tanks area;
- The substation area; and
- Fuel processing area, etc.

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Ground Conditions

Table 5.11.1 presents a summary of the ground conditions encountered beneath the plant site with associated depths:

Table 5.11.1 Summary of Ground Conditions beneath the Project Area		
Description	Depth to top (mbgl)	Depth to base (mbgl)
Loose, yellowish brown sandy Clay	0	7 to 10m
Reddish to yellowish brown clayey lateritic Sand with quartz nodules and concretions	7-10	8-11
Fine to coarse whitish to greyish slightly clayey Sand	7-11	11-30.5

Groundwater Conditions

At present, a groundwater survey has not been undertaken so the depth and quality are unknown. AES Sonel do however anticipate that the borehole will need to be in the region of 80m below ground level. Once the borehole has been drilled, AES Sonel will complete various water quality tests.

5.11.2 Potential Environmental Impacts

The primary impacts on soils arise from existing contamination.

Secondary impacts can also arise from the disturbance of soils and vegetation, leading to erosion. Spillage of oils and other potentially polluting substances during construction and operation may also lead to ground contamination.

Soil contamination

The following future and existing uses of the plant site and surrounding area could give rise to the issue of soil and or groundwater contamination.

Off-site Source of Contamination – Soap Factory

A visit to the plant site and surrounding area (September 2007) revealed a number of disused metallic drums, probably used for storing chemicals and or oils within the soap factory, discarded adjacent to the power plant site northern boundary. The ground surrounding these drums was observed with significant black staining. At the time of writing this report, no further information is available on the content and age of the drums or the origin of the black noted around the drums.

Soap production requires raw materials including, palm kernel oil, coconut oil, volcanic ash, dyes, perfumes, pigment, etc. According to the Industry Profile published by the UK Department of the Environment in 1995, potential contaminants associated with similar factories may include, but not limited to, organic compounds (e.g. Phenols, alkyl benzene sulphonates etc), inorganic compounds (e.g. potassium hydroxide, sodium hydroxide, titanium dioxide), and dyes. Leaks or spills of diesel or fuel-oils (containing polycyclic aromatic hydrocarbons (PAHs) and hydrocarbons) could have also occurred within the factory. Where the storage of raw materials / diesel / fuel-oil are unbanded or drums are just placed on the ground, any leaked or spilled from the tanks or drums could have potentially migrated to contaminate surrounding land.

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Potential Impact during Construction

Off-site migration of contaminants such as oil or acids from the soap factory could have contaminated the plant site. Contaminants in soil can chemically attack the buildings and associated ancillary structures. Similarly, the health of construction workers could also be affected, particularly during the earthwork phase of the project through dermal contact ingestion of contaminated soil, and inhalation of contaminated soil, dust and volatile organic compounds.

Where oils and chemicals are stored or used during the construction phase of the project, there exists the potential for spillages to occur leading to soil contamination. Where this occurs this can present a health hazard. Also, future land use potential will be reduced as the ground will not be productive or be in a suitable state for future built development. In addition such spillage has the potential to impact on both ground and surface water systems.

Contamination may also arise by the uncontrolled disposal of waste material at the plant site compound or the temporary construction sites. This may include off-cuts of wire, waste oil containers, packaging, etc. This can impact the current land use and may also affect local wildlife.

Potential Impact during Operation

Impacts arising from the operation phase will be mostly from the storage of oils and chemicals.

The eight diesel engines will be fuelled by heavy fuel oil (HFO) and occasionally by light fuel oil (LFO). The HFO and LFO are proposed to be stored within above-ground storage tanks of varying capacities, however total fuel oil storage capacity will be 6,500m³, these tanks will be bunded. There is a potential for spillage or leakage of fuel-oil from the tanks or due to fuel processing activities at the power station resulting in contamination of soils and / or groundwater with PAHs and general hydrocarbons.

Three aboveground storage tanks for oily water and lubricating oil (including waste lubricating oil and fresh lubricating oil), with a total capacity of 186m³, are to be used by the power station. Spills or leaks of oil from these tanks could also occur at the site resulting in soil contamination.

Leaks or spills from the oil transformer (potentially containing polychlorinated biphenyls (PCBs)) and other oil-filled equipment could result in the soil contamination particularly around the substation area of the power plant site.

Any leakages or spillage of fuel-oil or PCBs could results in ground and / or groundwater contamination due to infiltration of rainwater.

Decommissioning

The decommissioning works will in effect be a reversal of the construction operations. As such, the use of machinery on the plant site and along the transmission line corridor to facilitate dismantling and removal of buildings and materials, results in a potential for spillage of fuels and oils and therefore further soil contamination.

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5.11.3 Mitigation Measures

The implementation of, and adherence to the relevant construction contractors and KPDC's Construction Health and Safety Regulations/Policies, will provide protection to construction staff from contamination during construction. The site will be constructed and operated to relevant local, national and international standards/procedures/policies. An Environmental Management Plan (EMP), including waste management, will specify actions to mitigate soil contamination resulting from the proposed development, including the following:

Site Location

The operational area of the plant site is located at the furthest point from the soap factory, thereby reducing the likelihood of encountered migrating contaminants.

Site Controls

Where the power plant site is impacted by spills or leaks from the soap factory, construction workers could potentially be exposed to contaminated soil, groundwater or dust. As a minimum, construction workers should be supplied with appropriate personal protective equipment (PPE) such as safety boots, hard hats, chemical-resistant gloves and dust masks. In addition, site controls measures such as having designated areas for eating and drinking should be put in place. All trench workings will be kept well ventilated and dust suppression should be implemented particularly during dry, windy weather. Stockpiles of site-derived material may also be covered during these periods if dust suppression proves unworkable.

Waste Management

Soil arising generated from excavation during the construction phase intended for re-use on the site should be properly kept and if possible covered. All material delivered to site should either be utilised or removed following completion of the project. Key types of waste generated will be identified and appropriate handling and disposal requirements will be established in the EMP prior to the commencement of the construction phase of the project. Where required, contaminated material will be disposed of by a licensed contractor to a licensed waste site.

Tanks

The main method for the mitigation of potential fuel-oil contamination is to contain all bulk storage within a sealed bund with sufficient capacity to contain any spills. Where single bulk tanks are used, then the bunded area should have a minimum capacity of 110% of the volume of oils contained within it. If multiple small tanks are to be used and are not interconnected, then the bund should have a capacity equivalent to at least 25% of the total volume stored, or 110% of the largest tank, whichever is the greatest. All bunds should be inspected regularly to ensure that they do not become full of rainwater and to ensure their integrity.

All delivery and discharge pipe work and pumps should be enclosed within the bunds. Where pipe work leads from storage tanks to the diesel engines, all pipe work should be above the ground for easy inspection.

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Use of Catch Pits

At the substation area of the power plant site, the oil-filled transformer and any oil-filled equipment should be placed on oil catch pits capable of holding the entire volume of oils contained within the equipment. These pits should be regularly inspected to ensure no accumulation of rainwater.

General

The site should have an emergency response plan implemented during the operational phase and there should be spill kits located at various places around the site.

5.11.4 Evaluation of Mitigated Impact

Soil contamination

Construction / Decommissioning

During construction, the volumes of fuels and oils on-site will be relatively low as bulk storage is not required. Spillage or leakage may cause localised soil and / or groundwater contamination; the clean-up or remediation is dependent upon the quantity involved and the future uses of the area, these will be detailed in the EMP. In addition, basic measures such as placing tanks / or drums within concrete bunds or containment of any stored materials so as to stop direct discharge to the environment should be implemented.

Operation

The main potential impact of the project involves bulk storage of HFO, LFO, transferring and processing of fuel-oil at the power station. However, control systems for bulk fuel-oil storage and handling are in common use throughout the world and other AES Sonel power stations and, if correctly managed, are effective at preventing spillage to the environment.

With the implementation of the mitigation measures indicated above, the overall impacts arising from the project due to soil and / or groundwater contamination will be reduced such that the impacts are not significant.

5.11.5 Evaluation of Alternatives

The adoption of any of the proposed project alternatives would not significantly alter the overall impacts on soils and land use of the proposed development.

The zero (no project) option would remove the potentially negative impacts that may arise from the construction and operation of the project. However, during the environmental assessment of the project no significant impacts on soils and land use have been identified.

5.11.6 Conclusion

Provided all necessary mitigating measures are put in place during the operational phase of the project, any impacts arising from the proposed development would be minimal. A summary of the overall identified impacts is set out in Table 5.11.2.

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Table 5.11.2: Summary of Impact Evaluation – Soils							
Project Location	Phase²	Impact	Nature of Impact	Receptor	Nature¹	Duration¹	Significance¹
Plant site	C	Soil contamination (off-site migration of contaminants from nearby Soap Factory)	Construction in operational area of plant site	Construction workers Built environment soil and / or groundwater	Adverse	Long-term	Minor
	O	Soil contamination	Use of fuels and oils	Site workers / maintenance workers and site visitors Built environment Soils and / or groundwater	Adverse	Long-term	Minor
	D	Soil contamination	Use of fuels and oils	Site workers, soils and / or groundwater	Adverse	Short-term	Minor
Transmission line	C	Soil contamination	Use of fuels and oils	Construction workers, soil and / or groundwater	Adverse	Long-term	Minor
	D	Soil contamination	Use of fuels and oils	Same as above	Adverse	Short-term	Minor
1 – See Table 1.5.1 for definition 2 – Phase - C = Construction / O = Operation / D = Decommissioning.							

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5.12 WASTE MANAGEMENT

5.12.1 Baseline Conditions

From a site visit undertaken in September 2007, it was apparent that the project area (plant site and transmission line) consists of scrubs and subsistence agriculture. From visual inspections there seemed to be no waste dumped on the site.

5.12.2 Potential Environmental Impacts

Waste production will occur throughout the lifetime of the power plant, from site clearance, groundworks, construction, operation and decommissioning phases of the development. Wastes arising from the transmission line are primarily associated with wayleave clearance, pylon groundworks, wayleave maintenance and decommissioning. Waste arisings from construction of the access route to the plant site are considered relatively small and similar to those of the plant site's construction.

As no demolition works are required as part of the site preparation works at the plant site or transmission line corridor, demolition wastes are not considered further in the ESIA.

Site Clearance

During site establishment, all vegetation from the 7.7ha plant site (including the site and additional buffer area) will be cleared and removed to the site boundaries and left to naturally degrade.

The wayleave for the new 90kV line will require an area of 5.4ha to be cleared as it is approximately 1.8km long by 30m wide (15m either side of the centre of the power line). Prior to construction commencing, this wayleave will need to be cleared of all trees and tall vegetation with clearance to ground level. In addition, there will be a need to fell all trees greater than 15m that are located along the boundary of the wayleave.

As the transmission line corridor contains agricultural plantings, fallow, and regenerating secondary scrub, most clearance will involve removal of trees and under storey vegetation. The transmission line's construction compound area will be the same as that utilised for the plant site, thereby mitigating land take and reducing vegetation waste production.

Groundwork

The cleared plant site will require levelling, landscaping and backfilling of the operational area (4ha, required for the operational of the power station). There is the potential for excess spoil resulting from these activities, this will be utilised for site levelling and landscaping. Transmission line tower bases will also require ground clearance and levelling.

Construction Wastes

In addition to spoil waste from foundations for both the power plant site and the transmission line, there will be waste generated from construction materials. Waste from the construction of the plant site will include arisings from construction materials which are brought onto the site but are not used, packaging and from temporary structures that are dismantled / demolished at the end of construction. Presently, it is planned that the chain

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link fence used to mark the site boundary during construction will remain for the operational phase.

Domestic and sewage waste will also be produced by the workers during the construction phase.

Power Plant Operation

Waste will be generated during the routine maintenance and operation of the power plant. Operational waste arisings include:

- Sludge and water from oily water treatment;
- Water from the site drainage system;
- Domestic waste;
- Sewage waste; and
- Commercial office wastes.

Wayleave Maintenance

During the operational phase, vegetation within the wayleave must be managed to ensure that it does not interfere with the line (see Section 3.3.6). Vegetation management is usually undertaken once a year. During this vegetation is cut back to a minimum height of approximately 40mm to 60mm above the ground, where necessary. Maintenance of annual vegetation growth of an area of 5.4ha will not result in significant volumes of vegetation waste, despite the good growing climate.

Decommissioning

At decommissioning, a decision will be taken on whether the whole plant and transmission line be need to be removed. If this is the case there will be a significant amount of waste, including but not limited to conductors and steel from pylons, generators and tanks from the site. Some of the waste will be contaminated with oil and fuel. General waste arising will occur from activities such as the dismantling of the hardstanding, for example concrete.

The need to remove the concrete tower foundations will be dependent on the future land use of the site following decommissioning.

5.12.3 Mitigation Measures

In the case of waste management, all materials delivered to site will either be used or removed following completion of each phase. The site operations will be managed by the implementation of a waste management plan (WMP) which will set out the waste streams (the key types of waste that will be generated) along with their appropriate handling and disposal for both construction and operation. The WMP will be overseen by the EMP, a framework EMP for the project is included in Section 7 of this report.

Site Clearance

Land clearance will be minimised to retain vegetation for screening, ecological benefits and to reduce waste vegetation.

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Owners of crops will be notified of clearance and usable timber will be made available to local people.

Compensation for the loss of crops is dealt with in Section 6.

Groundwork

Excess materials resulting from site levelling, landscape and backfill will be stockpiled in an earth bund on the north external boundaries of the 7.7ha site. At present it is anticipated that this bund will be 2m high located to the north of the plant site. This will reduce the need to transport spoil material offsite. For the transmission line, it is planned that surplus natural soils will be spread over the adjacent area as only small volumes will be involved or be removed to appropriate disposal sites. The details of these areas will be included within the EMP and form part of the contractual obligation of the Engineering, Procurement and Construction (EPC) contractor. Items, such as wood, will be recycled, where possible and will be offered to local people.

Construction Wastes

Spoil produced during the foundation works both on site and along the transmission line will be sold or landscaped. The main plant elements are to be manufactured to standard specifications in Finland by Wärtsilä, the EPC contractor, and imported to Douala port for transportation to the plant site. The plant will be installed by highly skilled workforce provided by Wärtsilä. This construction method enables both a fast installation as well as minimising construction waste arisings.

The contractors installing the transmission line will take a similar approach and import the line's components ready for installation, thereby reducing wastes produced on site.

Where possible, construction wastes produced will be reused elsewhere on site or sold. If unsold they will be disposed of in an appropriate waste disposal site, by approved contractors.

Construction staff's domestic waste will be collected on-site in specified and appropriate containers by a private waste company and taken to the Government's landfill site at Nyalla, within Douala III.

In addition, appropriate sanitation facilities such as portable toilets or pit latrines will be provided at the construction site. Where required, all sewage will be appropriately stored in septic tanks and collected by an authorised waste carrier.

Power Plant Operation

Sludge arising from the treatment of oily water (the by-product of the burnt HFO) will be stored on-site for collection and removal by a local specialist waste contractor and incinerated within Douala III at regular intervals. All potentially contaminated water will be collected and treated prior to being discharged to a soak-away system or to the streams surrounding the plant site. Commercial wastes will be collected on-site and disposed of by an approved waste contractor. Welfare facilities and the foul drainage system will feed into a onsite septic tank for removal from site by a suitable contractor.

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Wayleave Maintenance

No burning of vegetation will be permitted within the wayleave as the soot and carbon can affect the power transmission lines. All cut vegetation will be removed from the wayleave during clearance so as to reduce the build up of dry matter under the lines which may inadvertently be ignited and cause large fires. However, within the warm humid climate of the project area vegetation will be left to rot and degrade within the wayleave. As part of the operational Environmental Management Plan (OEMP), a review of build up of dry matter will be undertaken each year to ensure this degradation process is effective.

Decommissioning

A strategy will be developed to evaluate the options for reuse, recycling and recovery of materials during decommissioning. The initial stage will be to identify if any of the structures or buildings on site have an alternative long-term use. This may apply to the offices, workshops, plant houses and other buildings that may be converted and used in other industrial and commercial processes. This decision process will be undertaken in consultation with the government and local communities. Any buildings and structures which can be retained will be identified and transferred to a suitable new owner. Any conversion works will be specified at the time of decommissioning.

Following this process the main power plant and electrical equipment will be dismantled and all steel and other reusable materials removed from site and recycled. All unwanted concrete foundations, car park areas, and similar will then be broken up and removed from site. Where volumes and demand allows these may be crushed (with reinforcing bar recovered) and reused as a construction aggregate. If this is not practical then all materials will be removed from site and disposed of to a suitable designated waste disposal site.

At decommissioning, the conductors will be lowered and removed from site for recycling and/or reuse. Following this the tower will be dismantled and the steel also removed from site for recycling. There will be limited waste produced during this operation although some equipment such as isolators and camps may need to be disposed of. Any waste requiring disposal shall be collected on site and then removed to a suitable designated facility.

If the tower bases are to be removed, the concrete will be dealt with as detailed above for the plant site.

5.12.4 Evaluation of Mitigated Impact

Site Clearance

It is an essential requirement for the project to clear the plant site and wayleave area of vegetation. The area cleared for the plant site, construction compound and wayleave is to be minimised through good definition of the site boundaries. Where possible vegetation in the form of crops or timber will be sold to or given to the local population, thereby reducing uneconomic waste of resources. Compensation for loss of crops results in an overall impact of the wayleave and site clearance as long term, adverse impacts of minor significance.

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Groundwork

Utilising the excess spoil arising from the site levelling, landscaping and backfilling activities to provide bund material removes the need to export spoil from site. Therefore, the impact from groundwork wastes are short term, adverse and will not be significant.

Construction Wastes

The manufacturing and importation of plant and skilled labour by Wärtsilä and the transmission line contractor enables the amount of wasted resources to be minimised during construction. Where waste is produced during the temporary construction period, is not able to be reused or sold, disposal to approved sites by waste contractors is determined to be a practicable option, as such the impact is deemed to be short term, adverse and of minor significance.

Power Plant Operation

AES Sonel is well versed in the management of wastes from thermal power plants utilising heavy fuel oil, from other plants, for example Limbe Power Plant. On-site treatment and storage facilities are incorporated into the design of the power plant and AES Sonel has established links to local specialist waste contractors able to collect and dispose of operational commercial and sludge wastes appropriately. As such, the impact from operational wastes is long term, adverse but not significant. The impacts of off-site discharge of treated domestic wastewater from welfare facilities is considered in Section 5.6.

Wayleave Management

Annual maintenance of the height of vegetation within the wayleave of the 1.8 km transmission line is unlikely to give rise to significant volumes of vegetation waste and maintaining this waste on-site within the wayleave to naturally degrade will result in short term, adverse insignificant impacts. However, the build up of dry matter must be reviewed annually to ensure the decomposition process is effective.

Decommissioning

The worst-case scenario for production of waste during decommissioning will be the required removal of all structures and equipment from the plant site and transmission line. In this situation, alternative long term alternative uses will be considered, on consultation with government and local communities. If dismantling is required, the waste hierarchy (reduce, reuse, recycle, recover, landfill) will be followed and where possible, material will be reused and recycled. Only where this is not practicable will material be disposed of at a designated waste disposal site. This sustainable hierarchical approach to waste will have long term, predominantly beneficial impacts of moderate significance, due to the high likelihood that materials and plant will be able to be resourced and utilised beyond their design life outside the Dibamba Power Project.

5.12.5 Evaluation of alternative development options

The adoption of any of the proposed project alternatives would not significantly reduce the overall arisings of waste from the proposed development.

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The zero (no project) option would remove the potentially negative impacts that may arise from the construction, operation and decommissioning of the project, however during the environmental assessment of the project no significant impacts from waste has been identified.

5.12.6 Conclusions

There are no identified potentially significant impacts on waste arising from the development of this project. Overall, waste during construction will be minimised, operational management approaches of wastes are all well developed and tried and tested. Decommissioning of the development will have beneficial impacts where the resourcefulness of the Government, AES Sonel and local communities will enable the waste hierarchy to be utilised. A summary of the overall identified impacts is set out in Table 5.12.1.

Table 5.12.1: Summary of Impact Evaluation – Waste							
Project Location	Phase²	Impact	Nature of Impact	Receptor	Nature¹	Duration¹	Significance¹
Plant site	C	Waste vegetation	Site/crop clearance	Local community	Adverse	Long-term	Minor
	C	Spoil production	Groundworks, excess spoil	Local area / community	Adverse	Short-term	Insignificant
	C	Construction waste production	Excess construction wastes	Local area / community	Adverse	Short-term	Minor
	O	Operational waste production	Power plant operation, sludge, commercial waste	Local area	Adverse	Long-term	Minor
	D	Plant and equipment waste production	Decommissioning requirement to remove all plant and equipment	Government, AES Sonel, local community	Beneficial	Long-term	Moderate
Transmission line	C	Waste vegetation	Site/crop clearance	Local community	Adverse	Long-term	Minor
	C	Spoil production	Groundworks, excess spoil	Local area / community	Adverse	Long-term	Insignificant
	C	Construction waste production	Excess construction wastes	Local area / community	Adverse	Short-term	Insignificant
	O	Vegetation waste production	Wayleave vegetation management wastes	Local area	Adverse	Short-term	Insignificant
	D	Plant and equipment waste production	Decommissioning requirement to remove all plant and equipment	Government, AES Sonel, local community	Beneficial	Long-term	Moderate

1 – see Table 1.5.1 for definition

2 – Phase - C = Construction / O = Operation / D = Decommissioning.

Section 6

Social Impact Assessment

SECTION 6: SOCIAL IMPACT ASSESSMENT

6.1 INTRODUCTION

The following section is based on the outcome of the scoping exercise, site visit, a household survey carried out in March 2006 for a similar project in the same province (Kribi Power Project, Mpolongwé, Scott Wilson 2006), public consultations, focus groups and a detailed sample household survey of the project area conducted in November 2007, and presents the results of the social impact assessment (SIA) for the Dibamba Power Project.

The SIA contains the following sections:

- Population and demographics;
- Economic environment;
- Social services and infrastructure; and
- Electromagnetic fields and community health.

Potential environmental impacts that can affect communities, such as water supply, air quality, land use, noise and traffic are dealt with in the Environmental Impact Assessment (EIA), see Section 5 of this report.

6.2 SIA METHODOLOGY

The overall approach to the SIA is set out in Section 4.

The terms of reference for the SIA, which were determined through the scoping study (see Section 4), established the social impacts considered to be potentially significant and therefore requiring detailed assessment. As such, the specific methodology for the SIA has been developed to ensure sufficient baseline data have been available to assess the potential social implications of the proposed power station.

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 with assistance from Safex (the local partner) to capture up-to-date project-relevant information and to provide an accurate baseline against which the significant potential impacts could be measured.

The overall aim of the survey was to provide quantitative and qualitative information useful for the SIA. The general methodology combined focus group discussions with traditional questionnaire surveys to generate primary information on the various socio-economic indicators.

6.2.1 Household Survey

Due to the low number of households directly affected by the project (up to 58¹), the sampling size for the Project Affected People (PAP) will be 95% (i.e. 55 households). In addition, in order to get a more precise understanding of the immediate surrounding area's socio-economic characteristics, an additional (14) questionnaires were undertaken in a randomly selected manner. 69 households were interviewed of which up to 58 households could be directly affected and the remainder indirectly affected. All of the indirectly affected households were chosen from the immediate surrounding areas of the project

¹ To be confirmed at the Resettlement Action Plan stage.

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(approximately 2km radius of the project). The programme for the survey is presented in Table 6.2.1.

The questionnaire was designed in conjunction with the local consultants, who are experienced in working in the area. The questionnaire was pre-tested on a small number of households (4) in close vicinity to the plant site and subsequently re-adjusted to better represent the issues and concerns of the affected communities.

Training of the surveyors was undertaken prior to the pre-testing of the questionnaire and again after the pre-test in order to discuss any issues that arose or any difficulties they encountered. A one-day training was also provided to the Health, Safety and Environmental Specialist from AES Sonel in order to allow for a better understanding of the aim and importance of the socio-economic survey.

As the sample households surveyed covered not only the plant site and the length of the transmission line (considered as one location due to its small size) but also the immediate neighbouring communities, three surveyors were employed so that both locations could be surveyed simultaneously whenever necessary.

Prior to interviewing households, consent was obtained from the household and village chief. Interviewees were given an overview of the Dibamba Power Project and the purpose of the household interview, and households were assured that the socio-economic survey would not influence, nor was involved with, the compensation calculations.

During the first day of the questionnaire survey, a socio-economic specialist was present in all interviews in order to further ensure that the surveyors understood the questionnaire and for quality control purposes. In addition, at the end of every day the questionnaires were reviewed by the team leader for inconsistencies. Whenever these inconsistencies rendered the questionnaire of no value the team was trained to take two approaches:

- For the households in the neighbouring communities, an additional questionnaire was undertaken for a different household, in order to replace it; and
- For the directly affected households, the team would need to revisit the household in order to clarify some of the questions that rendered the questionnaire of no value.

No questionnaires were considered 100% unusable and therefore none of the methods above were applied.

Finally, 5% (4) of the questionnaires were checked with the respective households in order to allow a final quality check of the information and to ensure that the team's analysis of data was a true reflection of people's situations.

Following the data verification, the results of the questionnaire were processed in an excel spreadsheet. The results of this analysis formed the basis of some of the baseline and potential impact assessments in the SIA.

The questionnaire data was further cross-checked and additional information obtained regarding the socio-economic conditions of the area through a semi-formal interview with the traditional chief of the Yassa Village.

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6.2.2 Focus Groups

Whilst the Socio-Economic Baseline (SEB) survey was being undertaken, two focus groups with women (approximately 5 to 10 participants each) were held, where the following topics were discussed:

- (i) Land ownership;
- (ii) Graves, graveyards, sacred places and medicinal plants;
- (iii) Natural resources use (including hunting); and
- (iv) Education and health facilities.

A programme of the household survey and focus groups is presented below.

Table 6.2.1: Programme for Household Survey and focus groups¹		
Days (2007)	Location	Task
Friday 16th November	Plant site and transmission line	Focus groups & Pre-test of questionnaire
Monday 19th November	Plant site and transmission line	Household Survey
Tuesday 20th November	Plant site and transmission line	Household Survey and Focus groups
	Neighbouring Yassa communities	
Wednesday 21st November	Plant site and transmission line	Household survey
	Neighbouring Yassa communities	
Thursday 22nd November	Plant site and transmission line	Household survey
	Neighbouring Yassa communities	
Friday 23rd November	Plant site and transmission line	Household survey
	Neighbouring Yassa communities	Final quality check of household survey

¹ Survey undertaken by Scott Wilson SIA team

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6.3 POPULATION AND DEMOGRAPHICS

This section provides an introduction to the main demographic characteristics of the project area and the potential impacts of the project on the local communities and their land and property.

6.3.1 Baseline Conditions

Overview

The project area is located in the Littoral Province, which has a total surface area of 20,220km², accounting for 4.35% of the total surface area of Cameroon. It has four Divisions: Moungo, Nkam, Sanaga-Maritime and Wouri, 24 Subdivisions and 5 Districts. In 1976, the Province had a population of 935,166 inhabitants rising to 1,352, 833 in 1987 according to the National census by the National Institute of Statistics, with an annual growth rate of 3.41% per annum. The Littoral Province population was estimated at 2,202,340 in 2004 (BBC, 2006).

Eighty-two per cent of the Littoral's population are urban dwellers. The majority of the urban population can be found in Douala City. The population density in Douala (Wouri Division) is 2,000 inhabitants per km². This population is very young with the average age being 21.9 years and 50% of the population is under 15 years old. The birth rate is lower in rural areas (35 births per 1000 people) than in urban areas (36 births per 1000 people), but the gross mortality rate is 9% in urban areas against 12% in rural areas. The Province's main town of Douala is Cameroon's commercial centre. Douala is perceived to have the most employment opportunities in Cameroon because of its relatively sophisticated infrastructure, which includes a port on the Wouri River, an international airport, a major railway and numerous roads linking Douala to other parts of the country and Africa.

Project Area

The project (the plant site and the transmission line) is located in the Yassa Village in the Douala III Subdivision, Wouri Division approximately 2km from the Dibamba River and 20km from Douala City.

The Yassa village is bordered by the Japoma Village, the Yatchika Village, Ngoti Village and Gwang village.

As described in Section 3, the plant site covers an area of approximately 7.7ha (operational area 4ha) and there is a 1.8km transmission line, which will link the power plant to the Ngodi-Bekoko substation at Bekoko.

According to the Scott Wilson survey of November 2007, the average number of people per household is 5, which is equal to the national average. Within this area, it is normal practice for graves to be located in communal graveyards instead of located within the house area. Two main graveyards were identified during the survey however these were located far from the project area.

Land tenure is characterised by customary land ownership (see Section 6.4 for a detailed explanation of Cameroon land tenure and laws).

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The Scott Wilson survey of November 2007 illustrated that the majority of the farming in the project area is carried out by households that are not living in the vicinity of the site but in the neighbouring villages and sometimes even further away such as Douala.

Project Area Socio-Economic Indicators

The inhabitants of the project area and immediate surrounding area consist of the following ethnic groups Bassa, Bamileke, Etone, Ewondo, Bekoko, Etton, Noni, Bangua, Yanbassa, Yabassi, Bouguila, Malimba, Toupouri and Haoussa. The majority of the Project Affected People sampled in the survey live by subsistence farming with some cash income gained from informal roadside business, such as fruit-selling. The project area and neighbouring communities have a good number of schools, health centres and churches. None of this infrastructure will be affected by the project.

The population is relatively old with people less than 15 years representing 34% of the population, against 41% at the national level for the year 2005 (UNSTATS quoted by BBC 2006). This is due to a large proportion of the young people moving to the nearby city of Douala to find employment. Households headed by women, 60 years or older represent 3% of those households surveyed. People with physical and mental disabilities were found in 10% of the households (Scott Wilson Household Survey November 2007); these population characteristics indicate that a number of the affected population could be vulnerable and require additional assistance in the event of land acquisition.

6.3.2 Potential Social Impacts

From a development of this type, where a corridor of land will be required, the one significant potential impact on the local population and demographics will be land requisition, which will in turn potentially cause:

- Resettlement;
- Conflict with Host Populations;
- Loss of Cultural Property; and
- In-migration.

Land Requisition and Resettlement

Construction

Potentially, the most significant social impact of the project will be land requisition and physical resettlement of people and businesses. At the start of the construction phase, it will be necessary to clear the land from the 7.7ha plant site location and from the 30m wayleave of the 1.8km power line prior to mobilisation of construction crews.

Independent of the SIA and in line with Cameroonian legislation, a full land and property census was undertaken by the Compensation Commission (in November 2007) established by the Littoral Divisional Officers, as specified by the Public Utility Decrees signed by the Minister of State Property and Land Tenure for the project on 19th November 2007. A detailed survey of project-affected land and property located in the footprint of the proposed plant site and wayleave has been undertaken by the Commission.

The results of this survey identified the following categories that will be affected by resettlement and land acquisition:

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On the plant site and transmission line route:

- 54 crop fields (belonging to 47 individuals²);
- 3 Buildings (one place of residence, one property under construction and one disused timber storage facility);
- 0 graves; and
- 25 titled lands (12 belonging to 10 individuals and 13 belonging to 6 companies/associations)

There are no households at the plant site and only 3 properties in the vicinity of the wayleave, which will be directly affected. Up to 47 households will lose access to the land they currently farm that is within the project area and 2 households will lose their houses and one business will lose its storage infrastructure.

Crop owners are individuals who will lose land and crops they cultivate. These owners will be given time to harvest seasonal crops, but not be allowed to plant again.

Building owners are those who will lose their residences or some sort of built infrastructure, and, in some cases, their land and crops as well.

Land take will also include tracts of agricultural land, the majority of which is held by customary land tenure rather than legal title.

As the affected population's livelihoods are largely land-based, the Dibamba Power Project may have a considerable effect on people's livelihoods. Impacts on land tenure and livelihoods are discussed in Section 6.4.

Operation

Resettlement will be completed before the physical construction of the line and therefore there should be no ongoing impacts during operation.

Conflict with Host Populations

Construction

Prior to physical construction, i.e. during the initial stages of the construction phase, the project will require the resettlement of 1 household and the land requisition from up to 47 households (including those with and without legal title).

Given that only one household requires resettlement and the number of different ethnic groups living in the area, no significant impact on host populations, due to greater pressure on their natural resource use and cultural differences, is expected. Nevertheless it is important to have a grievance mechanism in place for any dissatisfaction that may arise.

² The corresponding number of households will be confirmed during the Resettlement Action Plan stage.

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Operation

Any dissatisfaction between the host and resettled household that was initiated prior to and during the construction phase has the potential to continue into the operational phase of the project.

Loss of Cultural Property

Construction

With respect to cultural property, it has been identified from site visits, consultation and the household survey that among the project only has the potential to impact medicinal plants. The graveyards and sacred places are located very far from the plant site and no graves or sacred places have been identified within the project area. This is similarly applied to the existing sacred places. Thus there will be no impact on graveyards and sacred places.

However, the construction of the plant site and clearance of the wayleave will involve the potential loss of some species of medicinal plants (see also Section 5.9).

According to the Scott Wilson survey of November 2007, these medicinal plants are used by the different households in the treatment of common diseases and illnesses such as Malaria (58%), stomach illnesses (15%), yellow fever (3%) and diarrhoea (3%). Other ailments treated with medicinal plants include headaches, the flu and rheumatism. The majority of the households stated that they found the medicinal plants near their fields, however these were considered to be commonly available around the area.

In-migration

Construction

The construction phase of the project will require approximately 480 workers (see Section 3). The majority of these workers will be carrying out manual labour and therefore, where practicable, will be sourced locally from the Douala area. However, there will be the requirement for specialist staff from other parts of Cameroon and potentially expatriate staff moving to the Douala area for the construction and operational phase. The anticipated split between national and expatriate workers is 95% to 5% respectively.

A sudden influx of predominantly male contract workers could have a number of different impacts on the local population, including the transmission of sexually transmitted infections (STIs). Anecdotal evidence suggests that previous projects have led to the increase of STIs, including HIV/AIDS, as a result of unprotected sexual activity between contract workers and local women and girls. This could also lead to social tension.

There will also be potential pressure on local resources from the influx of workers during construction.

Operation

It is estimated that the operational phase will require a total of 40 staff working in shifts (10 operational; 15 maintenance; 12 security and 3 management). Wherever possible, local

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employees sourced during construction will be trained and retained for the operational phase.

Within the wayleave, vegetation taller than 2m must be cleared on an annual basis, see Section 3. This maintenance will be carried out by specialised companies, who will use a small number of local people for the manual cutting of bush. This may present some employment opportunities for local people. There will, therefore, be no in-migration associated with this latter assignment and this will not be assessed further.

Decommissioning

The impacts of in-migration at the decommissioning phase will be similar to those at the construction phase. However, the number of workers required at this phase will be less and therefore, the potential impacts are not predicted to be as severe. In addition, experience of impact mitigation gained during the construction phase can be used, which will further reduce impacts at decommissioning.

6.3.3 Mitigation Measures

Land Requisition and Resettlement

The key mitigation measure to limit the impact of resettlement is project design and the locating of the plant site and transmission line corridor in uninhabited areas. As such, a detailed assessment was undertaken of 7 alternative sites (three barge based and 4 land based), also see Section 3. From the land based sites, the Dibamba site was chosen mainly to avoid resettlement requirements. The line has also been designed to avoid residential properties wherever possible. This has resulted in the line not passing straight to the Ngodi-Bekoko substation at Bekoko but deviating at one point in order to avoid a residential area.

As identified in Section 6.3.2, there will be the need to displace one household (the second house was still under construction in November 2007) and take agricultural land from 38 households. To mitigate the impact on this household a Resettlement Action Plan (RAP) will be implemented in accordance with World Bank Operating Policy (OP) 4.12 and International Finance Corporation (IFC) Performance Standard 5 on land acquisition and involuntary resettlement.

The objectives of the World Bank's policy on involuntary resettlement are that it should be avoided, where feasible, or minimised – all viable alternatives should be explored. As noted above, for the Dibamba Power Project this has been undertaken with reference to both the siting of the transmission line and the plant site. Given that only one household will be displaced (whilst in total two households will have their infrastructures destroyed), these should be further consulted. In addition, all PAPs should have opportunities to participate in resettlement programmes and should be assisted to improve their livelihoods and standards of living. One of the key objectives of the guidelines is to restore the income earning capacity of Project Affected People (PAPs). The aim is to improve or, at the very least, sustain the living conditions of the PAPs prior to project operations or to resettlement.

It is therefore proposed that AES Sonel develop a full RAP for the Dibamba Power Project. In order to provide guidance on the requirements for this plan, an outline of a RAP can be found in Appendix L. A key feature of the RAP will be the fair and transparent compensation procedures that will ensure that each project-affected person is adequately compensated for his/her loss of property/land and income as a result of the project.

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In summary, the key stages of a RAP are:

- **Preliminary RAP preparations** – data review and research, and inception meetings with AES Sonel and relevant stakeholders, a lot of this preliminary work has been undertaken as part of the SIA;
- **Technical Design and RAP preparation** – this would involve sensitisation meetings / public consultation. This process has been initiated in the SIA;
- **Field Surveys** – which would involve detailed data collection on the affected households. For Dibamba this is to be undertaken through detailed census by the Compensation Commission. It will need to be supplemented by household surveys of properties not surveyed as part of the SIA;
- **Preparation of the RAP** – the outline is presented in Appendix L; and
- **Implementation of the RAP** – the RAP should be implemented, and therefore compensation agreed and paid and/or physical resettlement undertaken, before physical construction of the project commences.

Preparation for the RAP has already commenced with data collection undertaken during the Scott Wilson household survey and a census survey undertaken by a Compensation Commission in November 2007, which identified the project-affected people that are summarised in Section 6.3.2. The results of the survey are currently being thoroughly analysed and will form the basis of compensation criteria and assistance in the RAP. The Commission is a government-appointed body, tasked with evaluating, inspecting and delimiting land and property affected by a public utility decree (see Appendix L for the Public Utility Decree for Dibamba). The Commission comprises of the following members or their representatives from the following organisations:

- The Senior Divisional officer;
- The Divisional chief of service of State Property;
- The Divisional chief of service of Land Registry;
- The Divisional chief of service of Housing and Urban affairs;
- The Divisional chief of service of Agriculture;
- The Divisional chief of service of Mines, Power and Energy;
- The Representative of AES Sonel; and
- The Chief of the Yassa village.

Loss of Cultural Property

As mentioned above in Section 6.3.1, the graveyards are located very far from the project area and neither graves nor sacred sites have been identified within the project area and therefore they will not be assessed any further.

However, the construction of the plant site and clearance of the wayleave will involve the potential loss of some species of medicinal plants, which are considered endemic to the area, and therefore their loss will not significantly affect the overall population of these species.

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Conflict with Host Populations

As mentioned above, only one household will need to be physically displaced with another household losing their house that was under construction. The key mitigation measure will be to resettle the affected households, if possible, within their existing village. From consultations with the traditional chief of the Yassa Village, communal land within the village is available for this resettlement and therefore no impacts on host communities are foreseen.

However, it is important that the households are consulted early in the process about possible resettlement and whether the proposed resettlement sites are acceptable to them, both economically and socially.

In-migration

The key mitigation measure will be to minimise in-migration through the employment of people from the local communities, wherever appropriate and practical.

The impact of in-migration of workers during the construction phase will be mitigated by locating workers in the city of Douala, which has existing suitable accommodation and resources. This will enable workers to reside in comfort without depleting the scarce resources of the project-affected villages.

Contract workers should be sensitised and briefed on appropriate behaviour while working in the project area. Contract staff should also be made aware of the local culture and norms. Local communities and contract workers should be given information on safe sex practices. This should be done in consultation with the local health centres and in line with their safe sex campaigns. The project planners should plan the arrival of contract workers so as to mitigate the impact of a large inflow of people.

6.3.4 Evaluation of Mitigated Impact

Land Requisition and Resettlement

The project design has limited the requirement for resettlement through the routing of the transmission line and siting of the plant. As discussed in the impacts section, it is estimated that a maximum of one household will need to be resettled, one household will need to rebuild its house on a different location and 38 households will be directly affected by land requisition regarding their crops. The implementation of a well-planned RAP with fair compensation procedures will mitigate the most significant short-term impacts of resettlement and land requisition. If undertaken in accordance with OP 4.12, which requires betterment, long-term impacts can also be mitigated. Robust monitoring and reporting plans will also be implemented as part of the plan.

The impact of land requisition and resettlement is therefore considered to be long-term and minor. The impact will be adverse in that it will cause disruption to the individuals involved. However there is the possibility for better properties to be provided in compensation and this has the potential to be beneficial.

Land requisition and resettlement will be required during the initial stages of construction and therefore there will be no direct impacts during the operational phase.

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Conflict with Host Populations

Wherever practicable, resettlement should be undertaken within the same village to mitigate against conflict with host properties. With the exception of the plant site, the resettlement will only need to be to outside of the 30 m wayleave and, as mentioned by the traditional chief of the Yassa village, land should be available in the village.

Given the unlikely requirement for resettlement of the affected household outside of their existing village, and with the implementation of the RAP it is considered that the impact of conflict with host populations insignificant.

Loss of Cultural Property

The project has been designed to minimise the loss of cultural property, only affecting medicinal plants that are endemic to the area. As such, the impacts on the loss of cultural property are considered to be adverse, short-term and minor.

In-migration

It should, be noted that the in-migration will primarily be in the construction phase. There will be 480 employees required for the construction at the peak of this phase and it is anticipated that if the necessary skills are available, they will be recruited locally.

Sensitisation of both the local communities and the contract workers about issues of safe sex and general behaviour should minimise the negative impacts of a rapid temporary increase in the local population.

The short-term overall impact of in-migration could be significant. An influx of over 400 people could have an impact on the social norms of the community as well as being a strain on local resources.

6.3.5 Evaluation of Alternative Development Options

The adoption of any of the proposed project alternatives would not significantly alter the impacts of resettlement, as land requisition would still be necessary.

The zero option would remove the significant negative impacts of resettlement and land requisition and the impacts of in-migration during construction. However, if mitigation measures are carried out the project could have a positive impact by creating job opportunities and training.

6.3.6 Conclusions

The potential impacts on population and demographics, as discussed in Sections 6.3.2 to 6.3.4 are summarised in Table 6.3.1.

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Table 6.3.1: Summary of Impact Evaluation – Population and Demographics

Project Location	Phase²	Impact	Nature of Impact	Receptor	Nature¹	Duration¹	Significance¹
Plant site/ Transmission line	C	Land requisition and resettlement	Land requisition & Resettlement	Local communities	Adverse / Beneficial	Long-term	Minor
	O		Land requisition	Local communities	Adverse	Long-term	Insignificant
	C/O	Conflict with host population	Conflict	Host and resettled populations	Adverse	Short-term	Insignificant
	C	Destruction of cultural property	Land requisition	Local communities	Adverse	Short-term	Minor
	C/O/D	In-migration	STIs/Social conflict	Local communities and contract workers	Adverse	Short- term/Long- term	Significant
<p>1 – see Table 1.5.1 for definition 2 – Phase - C = Construction / O = Operation / D = Decommissioning.</p>							

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6.4 ECONOMIC ENVIRONMENT

6.4.1 Baseline Conditions

This section provides an overview of the economic characteristics of the area, which will be affected by project activities (i.e. in the Project Area as shown on Figure 1.1.2). The data was gathered from official sources and from interviews and meetings with the local community at the proposed plant site and within the village that will be affected by the proposed transmission line corridor, and household survey interviews with a selected sample of villagers undertaken by Scott Wilson in November 2007 (see Section 6.2). As discussed in Section 3.2.1 and shown on Figure 1.1.2, the project lies within the Littoral Province.

The Littoral Province has a vibrant local economy with urban and rural markets being found throughout the Province. Rural markets are held in Subdivisions and villages. The Province, through Douala, lies at the 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 Province has a large capacity for producing electricity through hydroelectric plants. The two main hydroelectric plants (Edéa and Songloulou) are located in Sanaga-Maritime Division on the Sanaga River. The populations of Douala city and Douala-Edéa consume approximately 46% of the region's electricity production. However, when taking into account the province's total population and the proximity of electricity plants, the number of electricity subscribers is low. According to the Scott Wilson household survey of March 2006 for a nearby power project (Kribi Power Project, Mpolongwé), poverty and some local level inefficiencies and poor access to services are largely to blame for the low subscription to electricity.

Douala is the main town within the Littoral Province. It has the highest urban density in the Province, as a result of the potential employment opportunities and the concentration of good infrastructure such as the port, international airport, roads and railways. The project area is characterised by moderate to severe poverty. Observations made during the household survey confirmed this status. Many people interviewed lived by subsistence farming or informal sporadic roadside business activities. In this context, informal sector business activities are those which lie outside the rules, regulations or fiscal demands of Cameroon's economy and are essentially illegal or illegitimate businesses but not necessarily criminal. The main sources of income in the project area were, in descending order of importance, informal sector (48%) of which agriculture was 34% and commerce 14%, the formal sector provided 33% of the main employment in various forms from drivers to working in the government and AES Sonel to construction workers such as carpenter and builders. 19% of the members of the household were unemployed. The survey showed that the population in the project area are predominantly farmers, people working within the commercial sector, skilled workers and unskilled workers.

Land Tenure

In Cameroon there are three main legal definitions of land ownership (AES Sonel, 2003b):

- Private Property of the State (PPS);
- Private Property belonging to Individuals (PPI); and
- National Land (NL).

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Private Property of the State

Private property of the State is moveable and immovable property acquired by the State for reasons of public use and private purposes (purchase and gift) following the rules of expropriation. The land title is held by the State (articles 10 and 11 of ordinance No. 74-2 of July 6th, 1974), which lays down the rules governing land ownership and its amendments.

Private Property belonging to Individuals

Private property belonging to individuals is registered and has title. It is land that is subject to: an order allocating State land as compensation; an order approving a sale by mutual agreement; an act of disposal of a piece of State landed property held as private property or an order allocating a piece of the national land to be developed (AES Sonel, 2003b) (see articles 2 to 15 of Decree No. 76-167 of April 27th, 1976, which lay down the modalities relating to the management of the private property of the State).

National Land

National land is made up of lands that do not fall in the public domain, the domain of the State held as private property, or in private property of individuals (see article 14 of ordinance No. 74 of July 6th 1974 in Limbe Power Project Compensation Action Plan, (AES Sonel, 2003b). This type of 'customary' ownership of National Land is typical of the land tenure of the householders surveyed, with 28% of respondents claiming to own 'ancestral' land. Inheritance in the Cameroonian context is transferred through a lineage system following the traditional customs and norms. Men normally inherit land from their fathers, while women traditionally do not inherit but can own land through purchase. For non indigenes, ownership and access to land is through purchase from the landowner and has to be channelled through the village authority that has the powers to declare control over a piece of land. A sales agreement is then issued to the new landowner (AES Sonel, 2003b).

Land Rental

Land rental is an informal process where land is occupied and tenants are obliged to give a percentage of their product from the land or a pre-agreed sum of money to the landowner.

Employment and Labour

The household baseline survey revealed that unemployment is around 13% among the surveyed people however when taking into account that 78% of the employment is either subsistence agriculture or informal sector, a secure employment only accounts for 22% of the people surveyed. As a result, during the interviews and informal meetings, the main concern about the project's impact was employment for members of the community with the local community believing that employment opportunities will have a significant impact on the local economy and individual households.

In addition, farming is the main livelihood activity for men and women, however, the survey found that a sizeable number of those surveyed had under-utilised skills such as carpentry, bricklaying and mechanics (6%). A smaller number of people had trained as electricians or drivers. The high level of unemployment in the region however, limits the opportunity for local people to gain employment whereby they can apply these technical skills.

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6.4.2 Potential Social Impacts

The key potential impacts on the economic environment that can arise from the proposed Dibamba Power Project are:

- Loss of land;
- Compensation discrepancy through land right disputes;
- Employment opportunities;
- Increased National Power Supply; and
- Economic benefits.

Loss of Land

The base case for the project assumes that all formal land uses and any built development at the 7.7ha site and along the wayleave will be lost to the current land occupiers.

As discussed previously the main source of income is from the land at the plant site and along the wayleave. Income is derived from subsistence and minor cash crop agriculture. The construction of the line will require the loss of agricultural land that is located within the 30m wide wayleave (see also Section 3), which has the potential to represent a significant economic loss for the affected population.

Compensation discrepancy through land right disputes

As stated in Section 6.3.2, the project will affect three properties that lie directly within the wayleave and farmland at the plant site. The building owners and crop owners are to be compensated through the implementation of a comprehensive Resettlement Action Plan (RAP). This will require land ownership within the area to be verified, to ensure that satisfactory compensation payments are met and that the rightful owners and users of land are compensated.

On a national scale only 6.1% of the population have legal title to their land of which the majority are in urban areas (Annuaire statistique du Cameroun, 1997). The survey showed that, 11% of the sample households surveyed claim to have legal title for one or more of their lands; whilst 22% of people interviewed declared that the lands they occupied were ancestral; and 45% of people interviewed stated that their land on which they farm and/or reside is rented. The remaining households interviewed (16%) stated they did not have land (e.g. roadside sellers) or that they did not know the ownership status of the land.

The issues of legal land titles and disputes over the legality of land ownership could be a significant issue in the project area during the compensation procedures as ancestral or customary land does not have legal title but can often be quite valuable and is recognised under Cameroon law.

If not managed, long-running land disputes between individuals and communities could be exacerbated if the compensation is not fair and transparent and if it fails to meet the World Bank/IFC standards, which require payment of compensation to people without legal title. This approach will be employed for the Dibamba Power Project RAP.

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Employment Opportunities

The project will create some limited direct and indirect employment opportunities, primarily within the 15-month construction phase (approximately 480 employees at its peak), and during the decommissioning phase. There will also be job opportunities, to a lesser extent, during the operational phase (approximately 40 employees in total at the Dibamba power station) and through additional annual vegetation maintenance.

During construction, employment opportunities will range from manual labourers, through electrical and civil technicians and engineers, to site managers. The anticipated split between national and expatriate workers is 95% to 5% respectively. Employment from the local area will be encouraged, and will almost certainly be necessary on the transmission line route. However, given the quantity and skills of workers needed during the construction phase, it will be necessary to import the majority of manpower from neighbouring cities where the appropriate skill base exists.

With regard to the operation of the plant, this will require approximately 32 specialised staff, mainly engineers and technicians. AES Sonel will recruit new staff early in the construction process for the purpose of providing them extensive training during all phases of the project implementation. The selection process will be countrywide. However, some non-specialised jobs such as guards, cleaners etc. will be filled locally.

As mentioned above, secure employment is very low in the area and therefore the community has very high expectations regarding the potential job opportunities that the project will provide. These opportunities will help to reduce unemployment and poverty. In addition, employment of local people, during construction and operation, will have a beneficial knock-on effect on potential employment in the secondary sector, e.g. service industries, such as supply of goods and services.

However, the majority of jobs will be short-term and unskilled. During construction, farmers may abandon farm work in favour of short-term lucrative work on the project. At the end of the construction, there is a high potential risk that they will become unemployed and some who have acquired skills will not necessarily be able to use them. As demand for jobs outstrips supply, there will be inevitable disappointment, resentment and possible conflict between those who have secured jobs and those who have not. The level of competition could lead to corruption and unfair recruitment. Those with connections to the local authorities and the better educated are likely to be in an advantaged position to secure jobs either from sub-contractors or AES Sonel. However AES Sonel's code of conduct for fairness and transparency, which it imposes on its subcontractors, should mitigate against this potential negative impact.

Increased electricity supply

During recent years households have been negatively affected by the insufficient supply in energy; which has hindered the development of economic activities. This project, by increasing the supply in energy, should help boost economic activities.

It should be noted that the project involves the installation of a power plant and a 90kV line only. It does not cover local power distribution. Transmission from this voltage line to the area is outside of the scope of this assessment, although, provision of electricity is a key concern of the local communities as only 49% of the people surveyed had electricity.

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Economic Benefits

The project, through increased employment, will provide increased national revenue through the payment of taxes by employees.

During construction, operational and decommissioning phases the project will also help boost activity in the secondary sector through the demand for goods and services. This will further increase employment and national and local government revenue. However, following decommissioning, these benefits may be lost unless additional employment and/or business opportunities become available.

The rapid influx of money and demand for goods and services, primarily through the construction and decommissioning phases, could lead to an increase in the prices of some scarce goods. This will have a negative impact on local communities that experience an increase in the cost of produce, but a positive impact on local small businesses selling these goods.

6.4.3 Mitigation Measures

Loss of Land

The key mitigation for the loss of land, and therefore income from that land, occupied and used by local populations, is through project design. As such, the location of the plant site and route of the line has been designed to avoid existing settlements, wherever practicable.

Where land and farms are located within the area of land take, compensation in accordance with the World Bank Operational Policy 4.12 and IFC Performance Standard 5, needs to be given to those people who suffer loss of land and/or income as a result of the project. Where appropriate, people should also be given assistance in finding alternative livelihoods. The categories of assets that may be lost are mainly fallow land, crops, trees and buildings.

Compensation should be provided within a formalised Resettlement Action Plan (RAP) for the project, explanation on requirements of RAP and compensation procedures are provided in Section 6.3.3 and a framework RAP is provided in Appendix L.

Compensation discrepancy through land right disputes

The potential impact of compensation discrepancy through land right disputes will be mitigated through comprehensive resettlement/compensation procedures, as discussed in detail in Section 6.3.3.

Rigorous data gathering and land inventory will be required to provide people with adequate compensation for loss of land and crops during resettlement. The Compensation Commission utilised for the Dibamba Power Project will need to be able to verify the ownership of land, as the majority of affected people do not have legal land title. Another potentially difficult issue to address is that a small minority of landowners are absent on a seasonal basis or may live permanently abroad. The identities and addresses of these people will need to be confirmed.

The compensation process should be undertaken in accordance with the World Bank's OP 4.12 and IFC guidelines, which provide for the compensation of people without legal title. It should also be noted that those without legal title who are on ancestral land should

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be regarded as landowners with full rights and not squatters. The World Bank/IFC policies do insist that squatters should be given compensation for crops lost as well as providing for assistance with moving if appropriate. Any ongoing land disputes will need to be investigated and moderated by an impartial third party. Regular consultation with project-affected people will also invoke trust and understanding of the project process. Project-affected people should be compensated for loss of land, loss of income and potential income. This could involve providing training or assistance to develop new livelihoods skills, if necessary. This should assist to mitigate any disputes or perceptions of mistreatment and corruption.

Employment Opportunities

A good local employment policy needs to be enforced to ensure fair allocation of jobs within the project area and to provide local people with transferable skills that can be used after the construction, operation and decommissioning phases of the project. Specific training programmes for local people would enable people to gain these skills. Small business grants or loans could also facilitate the growth and maintenance of local small businesses that could be sustained after decommissioning.

Increased national power supply

As this is a positive impact, there is no need for mitigation measures.

Economic benefits

Although this is a largely positive impact there is a risk that new revenue will fuel inflation. Mitigation will be largely dependent on national Government policies that are tailored to protect the poor, such as progressive tax rates and exemptions or assistance with micro credit loans.

6.4.4 Evaluation of Mitigated Measures

Loss of Land

Construction

If the RAP is produced and implemented as recommended, the short-term impacts of the project should be neutral to positive. The impact would be potentially positive if people are located to land which may yield better quality crops. It is very important that people get adequately compensated not just for loss of land and crops but also for temporary loss of livelihoods and incomes or business derived from land or businesses that have been relocated. When compensation is carried out, AES Sonel will need to manage the social strategy as carefully as the financial strategy. According to the survey the average landholding of those surveyed is approximately 0.17ha. Therefore, it is estimated that land take may not always affect the entire landholding of a household but nonetheless affect their crop yield even if only part of the land is taken. Therefore, land requisition for some people may be adverse, long-term and significant.

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Operation

Resettlement will need to be complete before physical construction commences and therefore no further impacts are predicted. There will therefore be no resettlement in the operational phase.

Compensation discrepancy through land right disputes

Construction

The management of the RAP will be crucial as land disputes and employment are very emotive and can lead to social conflict. If compensation is fair and transparent this should mitigate potential social conflict.

Within the project area, over 22% of the sampled landowners that may be affected claim to have customary land rights and only 11% of those sampled declared having legal title. Due to this low percentage of owners with clear legal title the potential for rights disputes is high. Whilst customary rights are recognised by Cameroon law and by the World Bank, the potential for disputes exist. People with customary land often do not have documentation. Equally, those who are in the process of obtaining title may have sent their documents as part of an application process that have not been returned.

Operation

Resettlement will be required prior to the physical construction of the project. Once construction is complete, and the project is operational, resettlement should have been completed. Therefore, no further impacts are predicted.

Employment opportunities

Construction

During the construction phase, up to 480 jobs will be created at the plant site and along the power transmission line. However, these will be short term (maximum 15 months but many shorter than this) and most will be low-skill labouring jobs. These will provide some temporary increase in income but limited opportunities for long-term skills training.

However, to maximise potential benefits during this phase, a sound recruitment, training and employment policy by the contractor and AES Sonel will mitigate the negative aspects of job competition and enhance the job opportunities created by the project. Where possible, longer term skills for some local personnel will be provided.

If the mitigation measures are carried out adequately, the impact of the construction phase on the local community will be beneficial, with short term, significant effects and lower significance long-term effects.

Operation

During the operational phase, a maximum of only some 40 jobs will be created. This will include management, administration, technical personnel, security and cleaning staff.

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Technical staff will be selected and trained up by AES Sonel and provide increased local skilled labour. In addition, all unskilled staff shall be sourced locally, where practical.

Overall, the scale of potential employment from the operational phase of this project is relatively low but will provide a degree of benefit to local people. In an area of high unemployment such as within the project area, even the relatively small number of jobs created should provide a beneficial, long term (25 year project life) significant impact.

Decommissioning

The decommissioning phase of the project will predominantly require low-skill manual labour. This will provide temporary employment opportunities but with limited scope for long-term skills training. The most significant impacts will be the loss of the 40 permanent staff at the plant site and the reduction in economic activity for service sector businesses in the local area. At the time of decommissioning, due consideration should be given to the wider economic impacts that may arise from the reduced employment and business opportunities in the area.

Economic benefit

Construction

As noted in Section 6.4.2, the increase in employment of up to 480 people during this phase will increase income to local businesses and government. However, this phase represents a short term but relatively large scale influx of people and therefore has the potential to cause local cost inflation for scarce goods. This will have beneficial effects for those involved in selling these products but negative impacts on local population who have to buy at the inflated price.

However, these impacts will only occur over the construction period (maximum 15 months) and therefore any impacts will be very short term in nature. Impacts will be potentially both adverse and beneficial although significant and short term in nature.

Operation

During the operational phase the overall level of economic activity will be lower but long term in nature. Employment of 40 permanent staff and the need to provide goods and services to the site will increase the overall economic activity within the project area. As such, impacts are assessed as beneficial, long term and minor in nature.

Decommissioning

As mentioned above, there will be both positive and negative economic benefits associated with the decommissioning phase.

6.4.5 Evaluation of Alternative Development Options

The adoption of any of the proposed project alternatives would not significantly alter the overall impacts on the economic situation of the local communities.

The zero option would remove the potentially negative impacts that may arise from the construction and operation of the project.

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The effect on employment opportunities of the zero option would be potentially negative as the jobs expected to be generated by construction and operation, respectively, of the project will not result.

6.4.6 Conclusions

Concerning the economic environment, the impacts will be positive during a limited period of time on the local population despite some minor negative impacts that can be mitigated through good compensation strategies and information and sensitisation campaigns. At the national level, the impacts will be positive during a longer period. The impacts are summarised in Table 6.4.1.

Table 6.4.1: Summary of Impact Evaluation – Economic Environment							
Project Location	Phase²	Impact	Nature of Impact	Receptor	Nature¹	Duration¹	Significance¹
Plant site/ Transmission line	C	Loss of Land	Acquisition of land	Local PAPs	Adverse	Long-term	Significant
	C	Compensation discrepancy through land right disputes	Conflict/reduced social capital	Local PAPs	Adverse	Medium-term	Significant
	C/O/D	Employment opportunities	Increased number of jobs	Local communities and contract workers	Beneficial / adverse	Short-term/long term	Significant
	C/O	Increased National Power Supply	Increased National Power Supply	Local and national	Beneficial	Long-term	Significant
	C	Economic Benefits	Economic Benefits	Local communities	Beneficial / Adverse	Short-term	Significant
	O				Beneficial	Long-term	Significant
	D				Beneficial / Adverse	Short-term/long term	Significant

1 – see Table 1.5.1 for definition
2 – Phase – PC= Pre Construction C = Construction / O = Operation / D = Decommissioning.

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6.5 SOCIAL SERVICES AND INFRASTRUCTURE

6.5.1 Baseline Conditions

This section provides an overview of the use and existence of key services such as schools, health centres, hospitals, water and electricity in the project area. The information presented is taken from the household survey interviews undertaken by Scott Wilson in November 2007.

Education

Children commence school at 6 years old in the project area, if their parents are able to pay for the uniforms and books (Scott Wilson, 2006). There are a number of primary schools in the Douala III subdivision but very few in Yassa village itself. In addition, there are none in the wayleave or the plant site and therefore none will be demolished as a result of the project. Nevertheless, one respondent indicated that there were plans for a proposed school in the wayleave. This will need to be confirmed by the full land census survey. Many of the children in the project-affected area attend schools in the neighbouring villages of Yatchika or Mbanga Bekoko, which are outside the project area.

In the project-affected villages, the level of literacy is high. The household survey found that of those surveyed, only 3% were unable to read and write. The percentage of people who had some form of formal schooling was also relatively high. Of the heads of households in the affected area, all men and 76% of women had attended school. This is despite the fact that primary schools are not very accessible for many in the affected area.

Health

The people surveyed mentioned over 26 different places of treatment, which indicates that the project area and surrounding area is well endowed with health facilities. This is further demonstrated by the fact that 60% of the households mentioned the local hospital as their main place of treatment and only 24% mentioned treatment at home with medicine bought from the market. Some of the most common health facilities mentioned were the Leproseries of Dibamba, Health Centre of Barcelone, Health Centre of Ndogpassi, Health Centre of Japoma and Health Centre of Oyack. These health centres are located in the surrounding villages and respondents mentioned the taxi and the moto taxi as their main mode of travelling (68%) to these centres, with only 16% travelling by foot.

The most prevalent diseases amongst those surveyed are malaria and diarrhoea; the incidence of malaria found during the surveys was 77%, which is very high compared to the national level of 45.9% and the Littoral provincial level of 45.8% (ECAM II 2000). Other diseases and illnesses include yellow fever (2%), tuberculosis (1%) and other (8%) (typhoid, rheumatism, grippe, hypertension and cardiac problems). Only 52% of sampled households are in possession of mosquito bed nets. The incidence of diarrhoea was found to be 15% which, when compared to 81% at Kribi (Scott Wilson, 2006) is very low. This may be due to the fact that 58% of the water sources are potable water, which come from boreholes that belong to water companies such as Sawawa, MAG and SNEC. Other sources include wells in yards (15%), and community boreholes (11%) that tend to tap the groundwater supplies and are normally potable.

The National (Cameroon) Committee Against AIDS 2004 found that the national HIV prevalence was 5.5%. In the Littoral province, the prevalence was 4.4% for men and 6.5%

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for women. HIV/AIDS is still very much stigmatised and people attribute their illness to other causes. This is clearly demonstrated in the survey as none of the respondents mentioned HIV/AIDS as an existing disease within the household.

Infrastructure

The Yassa village has access to the main primary road (tarred) that connects the Littoral Province to the South province as well as many other secondary untarred roads which connect it to the other villages. However, as very few people own or have access to private cars (7%) or motorbikes (16%), the roads are used mainly for walking or 'hitching a ride' to Douala or Edéa. The roads are, however, heavily used by other cars, lorries, buses, moto taxis and even trucks that service Douala.

Relatively wealthy people use shared taxis to take them to local markets where they buy and/or sell goods.

Water

The main source of water in the project area is the borehole (68%) followed by tap in the yard (11%) well in the yard (9%) and tap in the house (7%). When asked the location of the borehole, 24% of the respondents mentioned the water company Sawawa, 14% mentioned the company MAG, 11% the community borehole, and 14% other companies boreholes. Only 6% mentioned the groundwater local to the soap factory next to the project site.

Communications

Communication via radio (56%) is the main source of information in the project area. Friends (20%), television (13%) and mobile phones (6%) are also important communication means. In addition, 87% of households surveyed had mobile phones.

Electricity

Most households surveyed buy fuel for lighting which demonstrates a certain level of household wealth. Electricity is used by 49% of the households followed by petroleum (48%). Only 2% of the respondents mentioned wood and candles. Consequently, 80% of the households spend between 1001 to 5000 CFCA per month on lighting and 12% spend more than 5000 CFCA per month.

6.5.2 Potential Social Impacts

The key potential impact on the social infrastructure is:

- Pressure on health services.

In addition, there may be more minor impacts on the local education, communication and electricity services.

Pressure on health services

The health centres in the project areas will face a potential increase in the number of patients using their services. During the construction phase, up to 480 workers will be employed all

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of whom may require access to medical services. In addition, given the nature of the construction works and associated traffic, the incidence of accidents may increase.

It is possible that with an influx of predominately male contract workers, a rise in sexually transmitted disease, including HIV/AIDS could occur (see Section 6.3). This could place greater pressure on the health facilities.

Pressure on Water sources

During construction, there will be project staff in and around the plant site that will need sanitary facilities. Without proper measures this could lead to the contamination or degradation of the surface water. This impact is dealt with in Section 5.6 and therefore is not assessed further in this section of the report.

Education

As noted in the baseline, there are no schools within the wayleave or at the plant site, and as such there will be no need to remove school buildings.

Access to existing schools should not change. There are no children in the household that will require resettlement and therefore, there is likely to be minimum impact on journey times or distance for school age children. Access to school is not therefore anticipated to change.

The project will not involve a large influx of children requiring school facilities. During construction most labour will be local or unaccompanied/single men. This is a short-term phase (maximum 15 months). During operations, permanent posts will be created. However the overall level of employment (a total of approximately 40 working in shifts) is low. Where practical these will be local people. Therefore the potential increase in children moving to the area and requiring school facilities is low. This impact is not assessed further within the SIA.

Communications and electricity

The impact on communications will be neutral to positive. There maybe 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. This impact is not therefore assessed further within this SIA.

6.5.3 Mitigation Measures

The only issue where potentially negative impacts arise is in relation to the local medical services.

Pressure on health services

During the construction phase, the influx of workers has the potential to put considerable strain on the local medical services. Therefore, as part of the construction works additional provision will be made by the contractor to provide basic medical services, such as an

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on-site health post. During the operational phase, staff numbers will be approximately 40 in total. These workers will be located in towns where there are existing facilities.

Effective mitigation will also involve good sensitisation about STIs and HIV/AIDS as mentioned in Section 6.3. Additionally, the local health centres should be involved in any HIV/AIDS campaign that AES Sonel offers to its staff and the project-affected community. This ensures that local issues and mores are taken into account and that local solutions can be developed.

6.5.4 Evaluation of Mitigated Measures

Potential impacts on education facilities and local infrastructure have been assessed as insignificant and are not evaluated further. Impact on local water sources have been considered within Section 5.6 of this report and therefore these impacts are not assessed further within this section. The main potential impacts on Social Services and Infrastructure therefore relates to the healthcare.

Pressure on health services

Construction

Concerted and coordinated planning by AES Sonel, the construction contractor, the local communities and the health services will be able to minimise the impact on peoples' health and the resources of the local health facilities. This will include provision of basic health care services for the work force by the contractor (either directly or via support to the existing services) to over-come potential peak demand for medical assistance.

The impact will be greatest during the construction phase when up to 480 employees will be involved on site, a period of 15 months. However, work force numbers will vary over this period with average numbers being considerably below the 480 estimated peak. The potential impact on health facilities during this time is therefore considered to be adverse, short-term and minor in significance.

Operation

During the operational phase of the project, there will only be approximately 40 people employed on a full-time basis at the plant site. There will be occasional employment for vegetation clearance. The latter will primarily involve small numbers of the local population, who already use the local health resources. The introduction of the additional staff at the Plant Site will therefore provide an adverse, long-term but insignificant impact on health services in the project area.

6.5.5 Evaluation of Alternative Development Options

The adoption of any of the proposed project alternatives would not significantly alter the overall impacts on the health or social services of the local communities.

The zero option would remove the potentially negative impacts on health that may arise from the construction and operation of the project. However, the positive impacts on communications and electricity would also not occur.

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6.5.6 Conclusions

Generally, projects which involve a large influx of contract workers, can have a negative impact on the health and social well-being of communities. With mitigation measures in place these impacts can be minimised. If this does occur then the potential positive economic impacts of the project would outweigh temporary social 'adjustment' impacts. Table 6.5.1 summarises the impacts on the infrastructure.

Table 6.5.1: Summary of Impact Evaluation – Social Services and Infrastructure

Project Location	Phase²	Impact	Nature of Impact	Receptor	Nature¹	Duration¹	Significance¹
Plant site/transmission line	C/D	Pressure on health facilities	Pressure on health facilities	Health facilities, local communities contract staff	Adverse	Short term	Significant
Plant site/transmission line	O	Pressure on health facilities	Pressure on health facilities	Health facilities, local communities contract staff	Adverse	Long term	Insignificant

1 – see Table 1.5.1 for definition
2 – Phase - C = Construction / O = Operation / D = Decommissioning.

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6.6 ELECTROMAGNETIC FIELDS – COMMUNITY HEALTH

6.6.1 Baseline Conditions

Background

Electric and magnetic fields are present wherever electricity is used. For the last twenty years it has been widely debated as to whether 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 to EMFs to minimise the potential for shocks and interference with the body's nervous system.

A comprehensive literature review was undertaken of the most relevant and up-to-date information on this topic. This is included in Appendix L. From this, the potential for impacts to arise from the proposed power transmission line was assessed and the conclusions summarised below.

The information presented here and in Appendix L refers to the potential for impacts to arise from a 400kV transmission line. The transmission line between the Dibamba Power Station and the Ngodi-Bekoko substation will be 90kV. Therefore, the potential impacts of the proposed power line will be significantly less than the impacts presented.

6.6.2 Mitigation Measures

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.

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.

6.6.3 Evaluation of Mitigated Impacts

The International Commission for Non-Ionisation Radiation Protection (ICNIRP) advise the WHO, World Bank and independent states on the scientific basis for guidelines on exposure to electromagnetic fields. According to the ICNIRP research, evidence for EMF causing long-term, chronic, diseases such as cancer is not clear and therefore there are no guidelines based on this potential risk. The guidelines are based on short term, immediate health consequences such as stimulation of the peripheral nerves and muscles, and micro-shocks.

Only the higher voltage transmission lines at 400 kV would, under steady-state conditions, and directly beneath the lines, create a magnetic field maximum of 100 μ T (the ICNIRP

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reference value). However, typical values are approximately a tenth of this field value. The same applies to electric field for 400kV transmission lines, where maximum, steady-state, values could be above the reference value of 5kV/m but the typical values might only reach this. The magnetic and electric fields drop rapidly with the distance from the centrelines of the power line.

In conclusion, as the proposed transmission line is 90kV, not 400kV, it is highly unlikely to create an electromagnetic field above the ICNIRP guidance values even at the highest risk location, i.e. straight beneath the line. Nevertheless, there are countries with slightly different standards – including Italy, Switzerland and some states in the USA – which should be taken into consideration.

For the Dibamba Power Project the wayleave will result in the nearest properties being at a minimum distance of 15 m from the centre of the power lines. With the rapid decay in EMF with distance, at the edge of the wayleave all international standards should be met. It is therefore concluded that the impacts of EMF on community health is long term, local, but insignificant in magnitude.

6.6.4 Evaluation of Alternative Development Options

The adoption of any of the proposed project alternatives would not significantly alter the impacts of EMF, as the introduction of the 30m wayleave would still be required.

The zero option would remove the negative impacts. However, research has shown that the impacts of EMF on community health is long term, local, but insignificant in magnitude.

6.6.5 Conclusions

Table 6.6.1 summarises the impact evaluation.

Table 6.6.1: Summary of Impact Evaluation – Electromagnetic fields – Community health							
Project Location	Phase²	Impact	Nature of Impact	Receptor	Nature¹	Duration¹	Significance¹
Transmission Line	O	Electro-magnetic Field	Community Health	Local communities	Adverse	Long-term	Insignificant
1 – See Table 1.5.1 for definition							
2 – Phase - C = Construction / O = Operation / D = Decommissioning							

Section 7

Provisional Environmental Management Plan

SECTION 7 : PROVISIONAL ENVIRONMENTAL MANAGEMENT PLAN

7.1 INTRODUCTION

This provisional Environmental Management Plan (EMP) for the proposed project has been prepared as a standalone section of the ESIA report in accordance with both the requirements of Cameroonian legislation and the IFC standards and guidelines.

The requirement for an EMP to be included in the ESIA report is stipulated in the *EIA Decree of Cameroon, 2005 / 0577, 23rd February 2005*, which requires that an EMP to be included separately in the EIA report. The IFC Performance Standard 1 Social and Environmental Management Systems and World Bank Environmental Assessment Guidance OP4.01, Annex C (also referred to as an Environmental Action Plan (EAP) provides guidance on the contents of the EMP.

This provisional EMP is structured as follows:

- Environmental Policy;
- Project Overview;
- Register of Environmental Impacts;
- Environmental Standard and Quality Objectives;
- Mitigation and Implementation;
- Monitoring and Evaluation;
- Management Structure;
- Data Handling; and
- Audits and reviews.

The provisional Social Management Plan (SMP) is presented in Section 8 of this report.

Prior to the start of the power plant operations, both the provincial EMP and SMP will be developed into a full EMP and SMP that encompasses all aspects of mitigation, management, monitoring and institutional measures that will be undertaken by AES Sonel for the Dibamba Power Project.

The construction phase will be undertaken by various Engineering, Procurement and Construction (EPC) Contractors who will need to have their own EMP, which will meet the requirements of the ESIA and will need to ensure it implements the required mitigation measures.

The final EMP's produced by the construction contractor and AES Sonel should be compliant with ISO 14001: Environmental Management System.

Section 7: Environmental Management Plan

7.2 ENVIRONMENTAL POLICY

AES Sonel's Environmental Policy is presented in Appendix M.

7.3 PROJECT OVERVIEW

A project overview is presented in Section 3 of this report.

7.4 REGISTER OF ENVIRONMENTAL IMPACTS

The purpose of the EMP is to ensure that appropriate control and monitoring measures are in place to deal with all significant potential environmental impacts of a project. An impacts register therefore provides a focus for environmental management. The potential impacts of the project are discussed in Sections 5.3 to 5.12 of this report and are summarised in Table 7.4.1 below.

Table 7.4.1: Summary of Impacts - Environmental

Issue	Project Location	Phase ²	Impact	Nature of Impact	Receptor	Nature ¹	Duration ¹	Significance ¹
Air Quality	Plant site	C	Dust nuisance / heath risk	Dust rise from on site activity	Local population	Adverse	Short-term	Insignificant
		C	Reduced local air quality	Vehicle exhaust emissions	Local population	Adverse	Short-term	Insignificant
		O	Reduced local air quality	Emissions from power plant	Local population	Adverse	Long-term	Minor
	Transmission line	C	Dust nuisance / heath risk	Dust rise from on site activity	Local population	Adverse	Short-term	Minor
		C	Reduced local air quality	Vehicle exhaust emissions	Local population	Adverse	Short-term	Insignificant
Noise	Plant site	C	Increased noise levels	Construction activity	Local residents and soap factory	Adverse	Short-term	Minor
		O	Increased noise levels	Turbine operation	Local residents and soap factory	Adverse	Long-term	Minor
	Transmission line	C	Increased noise levels	Construction activity	Local residents	Adverse	Short-term	Minor
		O	Increased noise levels	Corona discharge	Local residents	Adverse	Long-term	Insignificant
Traffic	All road networks being used	C/D	Increased road traffic	Congestion	Local road users	Adverse	Short-term	Minor
		C/D	Increased road traffic	Accident risk	Local residents and road users	Adverse	Short-term	Minor
Surface Water Resources	Plant site	C/D	Water quality	Soil erosion	Surface water users / Environment	Neutral	Short term	Insignificant
		O	Water quality	Soil erosion	Surface water users / Environment	Neutral	Short term	Insignificant

Section 7: Environmental Management Plan

Table 7.4.1: Summary of Impacts - Environmental

Issue	Project Location	Phase ²	Impact	Nature of Impact	Receptor	Nature ¹	Duration ¹	Significance ¹	
		C/D	Water quality	Fuel / site drainage / foul water discharge	Surface water users / Environment	Adverse	Short term	Insignificant	
		O	Water quality	Fuel / site drainage / foul water discharge	Surface water users / Environment	Adverse	Medium term	Minor	
		C/O/D	Flow alteration	Change in run-off	Surface water users / Environment	Neutral	Medium term	Insignificant	
		C/O/D	Reduced surface water resources	Abstraction for site water supply	Surface water users / Environment	n/a	n/a	n/a	
	Transmission line	C/D	Water quality	Soil erosion	Surface water users / Environment	Neutral	Short term	Insignificant	
		C/D	Water quality	Fuel / site drainage / foul water discharge	Surface water users / Environment	Neutral	Short term	Insignificant	
		C/O/D	Flow alteration	Change in run-off	Surface water users / Environment	Neutral	Medium term	Insignificant	
	Groundwater Resources	Plant site	C/D	Water quality	Fuel / site drainage / foul water discharge	Groundwater users / Environment	Adverse	Short term	Minor
			O	Water quality	Fuel / site drainage / foul water discharge	Groundwater users / Environment	Adverse	Long term	Significant
O			Reduced Groundwater resources	Prevention of recharge	Groundwater users / Environment	Adverse	Long term	Minor	
C/D			Reduced Groundwater resources	Abstraction for site water supply	Groundwater users	Neutral	Short term	Insignificant	
O			Reduced Groundwater resources	Abstraction for site water supply	Groundwater users	Adverse	Long term	Significant	
Transmission line		C/D	Water quality	Fuel / site drainage / foul water discharge	Groundwater users / Environment	Adverse	Short term	Minor	
Landscape and Visual	Plant site	O	Landscape character	Industrial feature in rural setting	Landscape	Adverse	long-term	Minor	
		O	Visual amenity	Industrial feature in rural setting	Local population	Adverse	Long-term	Minor	
	Transmission line	O	Landscape character	Additional power line	Landscape	Adverse	Long-term	Minor	

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Table 7.4.1: Summary of Impacts - Environmental

Issue	Project Location	Phase ²	Impact	Nature of Impact	Receptor	Nature ¹	Duration ¹	Significance ¹
		O	Visual amenity	Additional power line	Local population	Adverse	Long-term	Minor
Land Use	Plant site	C/O	Land take	Construction of the plant site	Land use and soils	Adverse	Long-term	Insignificant
	Transmission line	C/O	Land take	Construction of towers	Land use and soils	Adverse	Long-term	Insignificant
		C/O	Land use	Change of land use in wayleave	Scrub/bush areas, farm land	Adverse	Long-term	Insignificant
Ecology	Plant site	C/O/D	Loss of habitats	Industrial feature in natural setting	Flora and fauna	Adverse	Long-term	Minor
		C/O/D	Alteration of habitats	Industrial feature in natural setting	Flora and fauna	Adverse	Long-term	Minor
		C/O/D	Habitat severance	Industrial feature in natural setting	Fauna	Adverse	Long-term	Minor
		C/D	Disturbance of wildlife	Industrial feature in natural setting	Fauna	Adverse	Long-term	Minor
	Transmission line	C/O/D	Loss of habitats	Additional power line	Flora and fauna	Adverse	Long-term	Minor
		C/O/D	Alteration of habitats	Additional power line	Flora and fauna	Adverse	Long-term	Minor
		C/O/D	Habitat severance	Additional power line	Fauna	Adverse	Long-term	Minor
		C/D	Disturbance of wildlife	Additional power line	Fauna	Adverse	Long-term	Minor
Cultural Heritage	Plant site	C	Levelling / Excavation	Construction of the plant site	Archaeological remains	Adverse	Long-term	Insignificant
Geology and Soils	Plant site	C	Soil contamination (off-site migration of contaminants from nearby Soap Factory)	Construction in operational area of plant site	Construction workers Built environment soil and / or groundwater	Adverse	Long-term	Minor
		O	Soil contamination	Use of fuels and oils	Site workers / maintenance workers and site visitors Built environment Soils and / or groundwater	Adverse	Long-term	Minor
		D	Soil contamination	Use of fuels and oils	Site workers, soils and / or groundwater	Adverse	Short-term	Minor

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Table 7.4.1: Summary of Impacts - Environmental

Issue	Project Location	Phase ²	Impact	Nature of Impact	Receptor	Nature ¹	Duration ¹	Significance ¹
	Transmission line	C	Soil contamination	Use of fuels and oils	Construction workers, soil and / or groundwater	Adverse	Long-term	Minor
		D	Soil contamination	Use of fuels and oils	Same as above	Adverse	Short-term	Minor
Waste	Plant site	C	Waste of vegetation of economic value	Site/crop clearance	Local community	Adverse	Long-term	Minor
		C	Spoil production	Groundworks, excess spoil	Local area / community	Adverse	Short-term	Insignificant
		C	Construction waste production	Excess construction wastes	Local area / community	Adverse	Short-term	Minor
		O	Operational waste production	Power plant operation, sludge, commercial waste	Local area	Adverse	Long-term	Minor
		D	Plant and equipment waste production	Decommissioning requirement to remove all plant and equipment	Government, AES Sonel, local community	Beneficial	Long-term	Moderate
	Transmission line	C	Waste of vegetation of economic value	Site/crop clearance	Local community	Adverse	Long-term	Minor
		C	Spoil production	Groundworks, excess spoil	Local area / community	Adverse	Long-term	Insignificant
		C	Construction waste production	Excess construction wastes	Local area / community	Adverse	Short-term	Insignificant
		O	Vegetation waste production	Wayleave vegetation management wastes	Local area	Adverse	Short-term	Insignificant
		D	Plant and equipment waste production	Decommissioning requirement to remove all plant and equipment	Government, AES Sonel, local community	Beneficial	Long-term	Moderate

¹ – See Table 1.5.1 for definition

² – Phase - C = Construction / O = Operation / D = Decommissioning

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7.5 ENVIRONMENTAL STANDARDS AND QUALITY OBJECTIVES

Wherever available, Cameroonian standards will be adapted to the project, which will be supplemented by international standards and guidance as necessary in consultation with the MoE. These will be supplemented by the IFC and other international standards and guidance as necessary and in consultation with the Ministry of Environment and Nature Protection.

As detailed monitoring programmes are developed, the standard applicable to each environmental media will be specified within the monitoring protocols.

7.6 MITIGATION AND IMPLEMENTATION

Mitigation measures are discussed in the EIA Sections 5.3 – 5.12 and are summarised together with Site Management (implementation of mitigation) in Table 7.6.1 below.

Control of most impacts is a function of correct operation and management of activities on site. Standard operating procedures (SOPs) for all plant and equipment that may have an impact on the environment will therefore be referenced within the plan. This applies to both the construction, operational and decommissioning phases of the project.

Specific operational control procedures will be developed to ensure on-going application of the EMP principles throughout the life of the power plant for non-standard operations.

Overall implementation in the construction phase will be the responsibility of the EPC Contractor.

Consultation is also a key mitigation measure and its implementation is considered key to the overall success of the implementation of the EMP.

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
Air Quality	Plant site / Transmission line	C	Dust nuisance / heath risk	Dust rise from on-site activity	<ul style="list-style-type: none"> Storage of materials on-site for re-use to reduce vehicular movement Regular inspections to ensure roads are swept and sprayed to minimise dust generation Storage areas to be 50m from sensitive receptors Appropriate site speed limit Minimal dropping heights shall be implemented and damping of potential dust generators will occur Minimise area of clearance Landscaping or hard standing cover on competed earthworks to be done as soon as possible Record all complaints 	Control procedures to be included within the EPC EMP	EPC contractor	AES Sonel regular inspection and audits
		C	Reduced local air quality	Vehicle exhaust emissions	<ul style="list-style-type: none"> Maintenance of vehicles in good working order 	Standard maintenance and daily visual inspections		AES Sonel audits of maintenance record and visual inspection of vehicles

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		O	Reduced local air quality	Emissions from power plant	<ul style="list-style-type: none"> Utilise specified stack height of 40m 	SOP developed for all plant	AES Sonel	<p>Continuous in stack monitoring for emissions</p> <p>Three month ambient air quality monitoring once the plant is fully operational in same positions as the baseline monitoring</p>
Noise	Plant site / Transmission line	C	Increased noise levels	Construction activity	<ul style="list-style-type: none"> Regular maintenance of all plant and equipment Not allow engines to run unnecessarily Undertake cutting, grinding and other operations within an enclosure Controlled loading and offloading of materials Noisy operations to be located at maximum distance from noise sensitive receptors Briefing staff on appropriate techniques and methods Control and limit traffic movements around the site 	Control procedures to be included within the EPC EMP	EPC contractor	Review complaints regarding noise via SMP liaison system

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		O	Increased noise levels	Turbine operation	<ul style="list-style-type: none"> • Exhaust gas silencer • Charge air silencer • Sound reducing properties to be incorporated into Power House walls • Construction of an earth bund on the northern edge of site • Stepping of the site through the site levelling process 	Specified within design	AES Sonel	Quarterly noise monitoring at sensitive sites for first year and when complaints received
		O	Increased noise levels	Corona discharge	N/A	N/A	N/A	N/A

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
Traffic	All road networks being used	C/O/D	Increased road traffic	Congestion	<ul style="list-style-type: none"> • A route management strategy will be formulated to minimise the interference of site related traffic with existing road users • Hours of operation will help minimise movements during peak traffic periods • Bus transport will be provided for the workers to reach the site • Convoys and specific vehicles will be used to transport equipment from Douala Port to the site • Marshalling of vehicles to minimise queuing of traffic • Warning of site access signs to be erected on the main road leading up to the site 	Control procedures to be included within the EPC EMP	EPC contractor	AES Sonel regular review of compliance of operations

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		C/O/D	Increased road traffic	Accident risk	<ul style="list-style-type: none"> • All drivers will be fully trained and qualified to operate and maintain the vehicles they drive • Drivers will be instructed to reduce speed and take account of local conditions, particularly when operating in villages and built-up areas • All vehicles will be properly maintained • All breaks, lights and warning signals will fully function • Signage will be erected on the main road leading up to the site to warn road users • Local villagers will be informed of the increased traffic and duration of works • The access road will have a specified speed limit • Local schools will be provided with information to educate the children about road and site safety • An emergency response plan will be developed addressing all eventualities 	Design and control procedures to be included within the EPC EMP	EPC contractor	AES Sonel review of compliance of operations

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
Traffic	All road networks being used	C/O/D	Increased road traffic	Accident risk	<ul style="list-style-type: none"> Drivers will have to adhere to a no drugs and alcohol policy Adequate space should be provided so HGV's will not have to reverse onto the main carriageway Construct an improved junction leading from the main road to the plant site 	AES Sonel through the design process	AES Sonel	AES Sonel to keep track on accident data and respond in an appropriate manner ensure the risk is reduced
Surface Water Resources	Plant site	C/D	Water quality	Soil erosion	<ul style="list-style-type: none"> Grass mats, crushed rock aggregate covering and geotextiles will be used to protect earth slopes and receptor ditches Silt fences will be installed at the down-slope extremes of the site working area 	Specified final design	Construction and decommissioning mitigation will be dealt with by the EPC contractor. Design and operational issues by AES Sonel	Design checks and on site monitoring during construction
		O	Water quality	Soil erosion	<ul style="list-style-type: none"> No discharge will be made directly to an unprotected or unstabilised area of open ground or watercourse 			

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		C/D	Water quality	Fuel / site drainage / foul water discharge	<ul style="list-style-type: none"> • Portable or pit latrines will be installed for workers • Temporary bunding will be installed around oil storage tanks • Loading areas will be bounded by lined interceptor trenches to prevent runoff / wash off / spillages or oil/diesel splashes • All grease, cleaning agents etc. will be stored within a secure container. Container to have a solid watertight floor and raised bund to contain any minor spillage 			

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		O	Water quality	Fuel / site drainage / foul water discharge	<p>As for construction plus:</p> <ul style="list-style-type: none"> • Back up fuel oil storage tank at the plant site to be constructed within a fully water tight containment bund will be a minimum of 110% volume of the largest contained tank or 25% of the total volume, which ever is greater. • All delivery and discharge pipe work for fuels will be installed above ground to enable full inspection for leaks or damage • Delivery areas are to be on hard standing with a slope to collect any spillage from delivery • Transformers will be constructed with catch pits below each unit • Drainage running from maintenance workshops will be fitted with an oil separator • All foul sewerage from the site will be fed to a septic tank system or similar for treatment prior to discharge 	Specified within design	Construction and decommissioning mitigation will be dealt with by the EPC contractor. Design and operational issues by AES Sonel	Design check and monitoring during construction

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		O	Water contamination	Incorrect discharge of waters in bunds and catch pits	<ul style="list-style-type: none"> All bunds must have a sump for removal of rain water, all pipe work and pumps are to be within the bund Catch pits will have drainage sumps to allow removal of rainwater and any oil spills 	AES Sonel		AES Sonel regular inspection and audits
		C/O/D	Reduced surface water resources	Alteration to the flow of local water courses	<p>Overall water abstraction for the project is very low so there is no specific mitigation, however, the following could be followed:</p> <ul style="list-style-type: none"> Vegetation system should not be fully removed Vegetation height should be kept to 40-60mm Vegetation clearance should be done during the start of the dry season No un-attenuated discharge of site runoff will be made to any local watercourse A drainage collection and storage system will be implemented on-site (depending on if this option is chosen) 	Specified within design. Inclusion within EMP procedures	EPC contractor	Monitor on site water use and AES Sonel to undertake regular inspection and audits

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
	Transmission line	C/D	Water quality	Soil erosion	<ul style="list-style-type: none"> Silt fences will be installed at the down-slope extremes of the transmission line working area 	Specified final design	Construction and decommissioning mitigation will be dealt with by the contractor. Design and operational issues by AES Sonel	Design checks and on site construction monitoring to design
		O/D	Water quality	Fuel / site drainage / foul water discharge	<p>As for construction and:</p> <ul style="list-style-type: none"> All delivery and discharge pipe work for fuels will be installed above ground to enable full inspection Transformers will be constructed with catch pits below each unit. Catch pits will have drainage sumps to allow removal of rainwater and any oil spills Drainage running from maintenance workshops will be fitted with an oil separator All foul sewerage from the site will be fed to a septic tank system or similar for treatment 			

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		C/O/D	Flow alteration	Change in run-off	<ul style="list-style-type: none"> Vegetation system should not be fully removed Vegetation height should be kept to 40-60mm Vegetation clearance should be done during the start of the dry season 	Specified within design. Inclusion within EMP procedures	Construction and decommissioning mitigation will be dealt with by the contractor. Design and operational issues by AES Sonel	AES Sonel regular inspection and audits
Groundwater Resources	Plant site	C/D	Water quality	Fuel / site drainage / foul water discharge	Mitigation measures for surface water should eliminate the risk of groundwater contamination	N/A	N/A	N/A
		O	Water quality	Fuel / site drainage / foul water discharge	Mitigation measures for surface water should eliminate the risk of groundwater contamination	N/A	N/A	N/A
		O	Reduced Groundwater resources	Prevention of recharge	<ul style="list-style-type: none"> Appropriate drainage to be incorporated into the design 	Specified within design	AES Sonel to incorporate with EPC Contractor	AES Sonel to undertake regular inspections to ensure system is in full working order
		C/D	Reduced Groundwater resources	Abstraction for site water supply	Mitigation measures for surface water should eliminate the risk of groundwater contamination	N/A	N/A	N/A

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		O	Reduced Groundwater resources	Abstraction for site water supply	<ul style="list-style-type: none"> A full groundwater yield assessment will be undertaken Should water be extracted from the groundwater aquifer below the site area, abstraction will be limited Discussions should occur with the soap factory to determine their abstraction rate 	AES Sonel EMP procedures	AES Sonel	AES regular inspection and audits
	Transmission line	C/D	Water quality	Fuel / site drainage / foul water discharge	Mitigation measures for surface water should eliminate the risk of groundwater contamination	N/A	N/A	N/A
Landscape and Visual	Plant site	O	Landscape character and visual amenity	Industrial feature in rural setting	<ul style="list-style-type: none"> The buildings and stacks will be painted to blend in with the sky A 2m high earth bund is being considered to the north of the site as well as having the site on 2 levels Re-vegetation of the bund and non-operational area 	EPC Contractor	AES Sonel	They should be re-painted every two years as a minimum

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
	Transmission line	O	Landscape character and visual amenity	New transmission line	<ul style="list-style-type: none"> The transmission line is routed parallel to existing areas of landscape disturbance Double circuit towers have been selected to allow a relatively low tower design to be adopted 	Specified within design	AES Sonel	Design checks and on-site construction monitoring to design
Land Use	Plant site	C/O	Land take	Construction of the plant site	<ul style="list-style-type: none"> The siting of the plant site was undertaken to avoid existing properties 	Specified within design and within EPC EMP	AES Sonel	Design checks and on site monitoring during construction
	Transmission line	C/O	Land take	Construction of towers	<ul style="list-style-type: none"> During final siting of the transmission line towers, existing land uses will be taken into account to reduce impacts Siting of the line was undertaken to avoid existing properties 			

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		C/O	Land use	Change of land use in wayleave	<ul style="list-style-type: none"> Informal agriculture may occur in the wayleave as long as vegetation is kept below 2m Access routes the transmission line towers will be planned to minimise disturbance to neighbouring cropping areas and should be along the wayleave Materials will be stored in a single location on the main power plant site 	AES Sonel / EPC construction contractor	AES Sonel /EPC construction contractor	Bi-annual surveys should be undertaken to ensure vegetation is not in excess of 2m
Ecology	Plant site	C/O/D	Loss and alteration of habitats	Industrial feature in natural setting	<ul style="list-style-type: none"> Project elements will be located in already disturbed areas e.g. existing road and transmission line corridor Enable re-vegetation post construction where possible Minimise land take during design process 	Specified within design	AES Sonel	Design checks and on site monitoring during construction
		C/O/D	Habitat severance	Industrial feature in natural setting	<ul style="list-style-type: none"> Enable re-vegetation post-construction where possible 	EPC EMP procedures	EPC contractor and AES Sonel during operation	AES Sonel regular inspection and audits
		C/D	Disturbance of wildlife	Industrial feature in natural setting	<ul style="list-style-type: none"> Control noise and areas of operation as far as is practically possible Control of vehicle traffic speeds 			

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
	Transmission line	C/O/D	Loss and alteration of habitats	Additional power line	<ul style="list-style-type: none"> Management of vegetation within the transmission line corridor to maintain the maximum cover permissible 	Wayleave management procedures	EPC contractor and AES during operation	AES Sonel regular inspection and audits
		C/D	Habitat severance	Additional power line	<ul style="list-style-type: none"> Enable revegetation post-construction where possible 	EPC EMP procedures	EPC contractor and AES Sonel during operation	AES Sonel regular inspection and audits
		C/D	Disturbance of wildlife	Additional power line	<ul style="list-style-type: none"> Control noise and areas of operation as far as is practically possible Control of vehicle traffic speeds 			
Cultural Heritage	Plant site	C	Levelling / Excavation	Construction of the plant site	<ul style="list-style-type: none"> After site clearance, an archaeological transect survey may be undertaken. If positive, further trial excavations should be defined at the most important locations Further surface prospecting and intrusive surveys (core samples) should be undertaken, where necessary Monitoring throughout both the survey and construction works by an archaeology specialist Preservation by record will be undertaken 	EPC EMP procedures	EPC contractor	AES Sonel regular inspection and audits

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
Geology and Soils	Plant site	C/O/D	Health and Safety	Site Controls	<ul style="list-style-type: none"> • PPE should be provided • There should be a designated eating area • Trench workings should be kept well ventilated and dust suppression techniques employed if required • Stockpiles should be covered during the dry season if dust suppression does not work 			
		C	Soil contamination (off-site migration of potential contaminants from nearby Soap Factory)	Construction in operational area of plant site	<ul style="list-style-type: none"> • The plant site is located at the furthest point from the soap factory 	EPC EMP procedures	EPC contractor	AES Sonel regular inspection and audits

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		O/D	Soil contamination	Fuels and oil storage	<ul style="list-style-type: none"> All bulk storage of fuel-oil will be contained within a sealed bund with sufficient capacity as specified by best practice e.g. 100% if single tank or whichever is greater 25% of the total volume stored if multiple tanks or 110% of the largest tank Delivery and discharge pipe work and pumps should be enclosed within the bund Pipe work should be above ground for easy inspection 	EPC and AES EMP procedures	EPC contractor and AES Sonel during operation	Weekly inspections during dry season. Daily during rainy season to ensure bund does not get full of rain water
				Failure of the catchpit	<ul style="list-style-type: none"> Oil-filled equipment will be placed on oil catch pits with the capacity to hold then volume of oil in the equipment 	EPC and AES EMP procedures	EPC contractor during construction and AES Sonel during operation	Design checks and on site construction monitoring to design
	Transmission line	C/D	Soil contamination	Use of fuels and oils	<ul style="list-style-type: none"> Good site management practice should occur e.g. all hazardous chemicals banded and on hard standing 			Daily inspection of oil bunds and separator
Waste	Plant site	C	Waste of vegetation of economic value	Site clearance	<ul style="list-style-type: none"> Usable timber will be made available to local people Land clearance will be minimised to reduce waste arisings 			

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		C	Spoil production	Groundworks, excess spoil	<ul style="list-style-type: none"> Excess spoil from civil works will be used for landscaping and the creation of the bund on the northern edge of the site 	EPC EMP procedures	EPC contractor	AES Sonel regular inspection and audits
		C	Construction waste production	Excess construction wastes	<ul style="list-style-type: none"> A skilled workforce that is highly trained and qualified will erect the power plant Construction wastes will be reused on site otherwise sold or disposed of The main plant elements are manufactured off-site minimising on-site construction waste Domestic waste will be collected by a private waste company at regular intervals for disposal at Nyalla All sewage will be stored in septic tanks and collected by an authorised waste carrier 			

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		C/O/D	Waste Management	Uncontrolled wastes	<ul style="list-style-type: none"> Contaminated material will be disposed of by a licensed contractor Material intended for reuse should be kept properly and covered Devising and implementation of a waste management plan 			
		O	Operational waste production	Power plant operation, sludge, commercial waste	<ul style="list-style-type: none"> Sludge will be removed from site by a local specialist waste contractor and incinerated All potentially contaminated water will be collected on-site and disposed of by an approved waste contractor 	AES Sonel EMP procedures	AES Sonel	AES Sonel regular inspection and audits
		O	Soil contamination	Spillage	<ul style="list-style-type: none"> Site emergency response plan should be implemented Spill kits should be available in strategic locations 	AES Sonel EMP procedures	AES Sonel	AES Sonel regular inspection and audits

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		D	Plant and equipment waste production	Decommissioning requirement to remove all plant and equipment	<ul style="list-style-type: none"> A strategy will be developed to reuse, recycle and recover materials Any buildings and structures which can be retained will be transferred to a suitable new owner The main power plant and electrical equipment will be dismantled and all steel and other reusable materials removed from site and recycled 	EPC EMP procedures	EPC contractor	AES Sonel regular inspection and audits
	Transmission line	C	Waste of vegetation of economic value	Site clearance	<ul style="list-style-type: none"> Usable timber will be made available to local people Land clearance will be minimised to reduce waste arisings 			
		C	Spoil production	Groundworks, excess spoil	<ul style="list-style-type: none"> Minimal spoil is predicted 			

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Table 7.6.1: Summary of Environmental Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Project Location	Phase ²	Impact	Nature of Impact	Mitigation	Implementation	Organisational Arrangement	Monitoring
		C	Construction waste production	Excess construction wastes	<ul style="list-style-type: none"> Where possible construction wastes will be reused elsewhere on site or offered to locals Excess wood will be recycled or offered to local people Transmission line components will be imported 'ready for installation' to reduce waste production 			
		O	Vegetation waste production	Wayleave vegetation management wastes	<ul style="list-style-type: none"> Where appropriate, vegetation will be left to rot and degrade within the wayleave Other vegetation will be removed from the wayleave during clearance 	AES Sonel EMP procedures	AES Sonel	AES Sonel regular inspection and audits
		D	Equipment waste production	Decommissioning requirement to remove all plant and equipment	<ul style="list-style-type: none"> The conductors will be lowered and removed from site for recycling and/or reuse Any waste requiring disposal shall be collected on site and removed to a suitable designated facility 	EPC EMP procedures	EPC contractor	AES Sonel regular inspection and audits

¹ – See Table 1.5.1 for definition
² – Phase - C = Construction / O = Operation / D = Decommissioning

7.7 MONITORING AND EVALUATION

The full EMP will provide a detailed monitoring programme, which is essential to ensure the project achieves its operating standards. However, it is equally essential that the data collected is accurate and reliable. Protocols will therefore be developed to control this monitoring. These will include the following:

- Sampling methods;
- Sampling location and frequency;
- Equipment types and calibration;
- Data recording and logging; and
- Routine audits.

Where off-site laboratories are to be used, these will be checked to ensure appropriate standards are achieved.

Emissions and releases

While in principle every emission or release requires monitoring, in practice not all monitoring will require application of strict quantitative methods. In many cases, visual inspection by a competent person will be sufficient, but in all cases, it is necessary that the EMP systematically evaluates each emission or release to ensure that the monitoring is adequate.

Table 7.7.1 indicates the monitoring which might typically be required for the forecast emissions and releases for the power plant. The precise methods, frequency and location of the monitoring will be detailed in the full EMP.

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Table 7.7.1: Example Environmental Monitoring Programme - Emissions and Releases				
Project Phase	Source	Monitoring system	Monitoring location	Frequency
Construction	Construction traffic	VRM	At all construction and compound sites	Weekly
	Vehicle exhausts (All project phases)	VM	All vehicles	Monthly
Operational	Plant stack emission	QR	On all plant stack	Continuous
	Plant stack emission	QR	Various as completed as part of baseline monitoring	Once for 3 months
	Plant site noise	QR	At nearest properties to site	Quarterly for first year and in response to complaints.
	Oils storage and welfare facility discharges	QRM	At monitoring wells to north, west and south of site.	Quarterly ground water sampling
	Water discharges	QR	At discharge point from the site	Every 2 months
	Groundwater quality	QR	At borehole	Annually
	All dust emission sources	VQRM	Dust deposition: soil sampling stations around site perimeter	Annually
Decommissioning	Earthmoving, recovery and demolition works	VQRM	Dust monitoring network on/around site	Fortnightly during works
Monitoring system: Q = quantitative, by analysis V = visual assessment M = multiple locations R = regular monitoring O = occasional monitoring N = not required				

7.8 MANAGEMENT STRUCTURE

As the national power provider in Cameroon, AES Sonel has an existing management structure to facilitate control of potential environmental and social impacts. As the Dibamba Power Project will represent a new entity, there are no project specific management structures to set out, and as such this plan provides the framework for the systems that will be put in place within the existing company structure.

This plan provides the framework for the management systems that will need to be put in place within the existing environmental department.

The EPC Contractor will need to have an EMP compliant with AES Sonel's requirements and include procedures to cover all elements noted within this framework plan.

When setting up this management structure the key elements to incorporate are as follows:

- A single named individual who will be given overall responsibility for environmental matters on site;
- A staff structure below this individual that will be defined in order to control all aspects covered under the plan;
- Staff within this structure that will be named individuals or be specific posts and a clear statement of their roles, responsibilities and competencies will be provided; and
- A clear line management and reporting pathway.

For an EMP to be effective there must be a formal responsibility for its implementation. As part of this, an Environmental Manager should be appointed, reporting to the power plants senior management. The designated Environmental Manager should have the following terms of reference:

- To implement and develop the EMP as set out in this report, including over viewing the EPC contractors environmental controls;
- To liaise with the regulatory authorities, obtaining and maintaining the necessary environmental permits, etc;
- To report to the project senior management on a regular basis;
- Assisting in define roles, responsibilities and competencies for all staff involved within the environmental management structure.
- To raise awareness of environmental issues and controls in the power project's workforce, especially in those areas that have a direct potential impact on the environment (e.g. the implementation of a compulsory induction course for all employees, contractors and subcontractors at the outset of the project will help ensure an overall understanding, which should be supplemented by specific training courses dependent on duties).

During construction, the management of the implementation of the detailed resettlement action plan will be a critical task to be managed and the environmental manager will need to

Section 7: Environmental Management Plan

work closely with RAP/resettlement unit team. In addition, the activities of the construction crew will need to be carefully monitored with respect to the requirements of the management plan.

Once constructed, the operation will have a relatively small-scale plant and the line will require minimal maintenance, during operation such staff may have dual responsibilities within the company.

7.9 DATA HANDLING

The management plan will include details of all data handling, storage and analysis requirements. The plan will identify the location where all data are to be held, staff responsibilities for data handling and analysis and appropriate reporting lines for ensuring management are aware of the current status of site operations.

This will include emergency procedures where monitoring indicates a failure of one of the on-site systems as well as routine reporting.

7.10 AUDITS AND REVIEWS

On a six monthly basis during construction and an annual basis during operation, all monitoring activities and operating practices will be subject to external auditing to ensure compliance with the management plan. This will include a review of all monitoring data and any incidence of non-compliances occurring during the year.

The results of the audit will be submitted to management for review and action will be taken to upgrade or modify any systems as required. The audit report will identify any failings in the current system and make recommendation for any changes deemed appropriate.

In addition, routine internal audits will be undertaken, typically on a three monthly basis to monitor the implementation of the stipulated monitoring programmes and management controls, such as handling and storage procedures at the port.

Section 8

Social Management Plan

SECTION 8 : SOCIAL MANAGEMENT PLAN

8.1 INTRODUCTION

This section presents a framework Social Management Plan (SMP) for the proposed project in line with international best practice. This document sets out all management action required to mitigate social impacts and includes an outline of the requirements for monitoring.

Prior to the start of construction AES Sonel will develop a detailed SMP in conjunction with the selected construction contractor.

8.2 SOCIAL POLICY

AES Sonel is committed to sustainable development and social responsibility. As such and as part of the detailed SMP, it will develop policies relating to employment and HIV/AIDS and other STIs. A copy of AES Sonel's environmental and social policy is presented in Appendix L.

8.3 PROJECT OVERVIEW

A project overview is presented in Section 3 of this report.

8.4 SOCIAL STANDARDS AND QUALITY OBJECTIVES

Wherever available, the standards of Cameroon will be used in the project, which will be supplemented by international standards and guidance. We are working to international best practice and as necessary, in consultation with the Ministry of Environment and Nature Protection.

The detailed Resettlement Action Plan (RAP), which will be developed, will provide the basis on which the resettlement and compensation of project-affected people will be conducted. The key principles of involuntary resettlement according to the World Bank's Operations Policy 4.12 and the International Finance Corporation (IFC) Performance Standard 5 are income and livelihood restoration and consultation of affected people.

8.5 REGISTER OF SOCIAL IMPACTS

The purpose of the SMP is to ensure that appropriate control and monitoring measures are in place to deal with all significant potential social impacts of a project. An impacts register therefore provides a focus for social management. The potential social impacts of the project are discussed in Section 6 of this ESIA and are summarised in Table 8.2.1 below. Only impacts with a potential significance (minor to significant) require management action.

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Table 8.2.1: Summary of Impacts - Socio-economics

Issue	Phase ²	Impact	Nature of Impact	Receptor	Nature ¹	Duration ¹	Significance ¹
Population and Demographics	C	Land requisition and resettlement	Land requisition and resettlement	Local communities	Adverse / Beneficial	Long-term	Minor
	O				Adverse	Long-term	In-significant
	C	Loss of cultural property	Land requisition	Local communities	Adverse	Long-term	Minor
	C/O	In-migration	STIs / Social conflict	Local communities and contract workers	Adverse	Short-term/long term	Significant
Economic Environment	C	Loss of Land	Acquisition of land	Local PAPs ³	Adverse	Long-term	Significant.
	C	Compensation discrepancy through land right disputes	Conflict/reduced social capital	Local PAPs	Adverse	Medium-term	Significant
	C/O	Employment opportunities	Increased number of jobs	Local communities and contract workers	Beneficial / adverse	Short-term/long term	Significant
	C/O	Increased National Power Supply	Increased National Power Supply	Local and national	Beneficial	Long-term	Significant
	C/O	Economic Benefits	Benefits	Local communities	Beneficial	Long-term	Significant
Social Services and Infrastructure	C	Pressure on health facilities	Pressure on health facilities	Health facilities, local communities contract staff	Adverse	Short term	Significant
	O				Adverse	Long term	Insignificant
Electromagnetic Fields (EMF)– Community Health	O	Electro-magnetic Fields	Community Health	Local Communities	Adverse	Long-term	Insignificant

All issues apply to the project footprint, i.e. both power plant and transmission line with the exception of EMF, which applies to the transmission line only

³ – Project Affected People

¹ – see Table 1.5.1 for definition

² – Phase - C = Construction / O = Operation / D = Decommissioning.

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8.6 MITIGATION AND IMPLEMENTATION

Mitigation measures are discussed in the SIA, Section 6, and are summarised together with Site Management (implementation of mitigation) in Table 8.6.1.

With regard to Electromagnetic Fields (EMF), prior to the start of final line survey, transmission line tower set-out and construction activities, all key site staff (site supervisors, contracts managers and site engineers) will be informed of the issues relating to EMF and be identified as key contact points by all site workers. Any questions arising from members of the public will therefore be directed to these individuals during the final planning and construction process. There are no physical environmental management issues relating to EMF effects other than ensuring the correct development and management of the wayleave.

Consultation of affected people is a key mitigation measure for the overall project, as experience has shown that when affected people are not adequately consulted a project runs the risk of being delayed and in some cases sabotaged. Thus, its implementation is considered key to the overall success of the implementation of the SMP as discussed below

8.7 CONSULTATION

8.7.1 Introduction

Public consultation is a key mitigation measure and general community approach that needs to be integral to all aspects of the project. The form that consultation takes will differ depending on the type of issue being raised, and the stage in the project cycle. AES Sonel and the project-affected community will devise the most appropriate method of consultation that is relevant and effective for the project. However, there are some core principles of consultation and key elements that need to be part of an effective consultation programme. Additionally, as has been mentioned in other parts of the ESIA, consultation and participation are crucial features of the RAP. Generally, the process for consultation for a RAP begins after the information from the relevant surveys has been finalised. Then resettlement planners can engage in consultation with the affected communities regarding the RAP strategy for livelihood restoration. Sometimes a committee of community representatives is appointed who can serve as a focal point for consultations on the types of assistance proposed as well as for the subsequent participation of the community in RAP implementation. Where host communities are affected by resettlement decisions, representatives of these communities should be included in these consultations. Therefore, what follows is a detailed framework, of principles and methods, for the consultation approach, which can be developed and augmented as specific issues arise during the lifetime of the project and the RAP.

8.7.2 Key Tasks

The following are international best practice approaches to consultation. These methods will be applied during the project development and operation, as necessary.

Design of Public Meetings

All public meetings will ensure that:

- People are well informed about the purpose of the meeting in advance;

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- Meeting venues are accessible to the attendees;
- Meetings are held at times that are convenient for people;
- Clear, non-technical information is presented in French and in local languages, as necessary, and there is a good mixture of visual and written information; and
- Issues raised are answered at the meeting or followed up within a timeframe.

Hold Targeted Smaller Consultation Meetings:

Large public consultation meetings are useful but do have their limitations. Throughout the lifetime of the project specific issues emerging from particular groups will need to be addressed, e.g. women or older people may have particular needs. The best way to do this is to have small focus groups with the people concerned, for example, a business group, a group of teachers, women or older people.

Document the Results of Meetings

The records should include:

- The location, dates of meetings, workshops and discussions and purpose of the meeting;
- An overview of the issues discussed;
- How issues were dealt with; and
- Details of outstanding issues.

Use local community groups such as NGOs:

- Sometimes the most effective communicators are local. Use local NGOs, churches and other community-based groups to help facilitate meetings and disseminate information about the project.

Implement Formal Grievance Mechanisms:

- The contact person for grievances should be a specific person within AES Sonel (e.g. the community liaison officer, human resources officer);
- The existence of the complaints procedure and how it works should be well publicised among the community;
- The grievance procedures should be transparent and simple to understand;
- Access to the procedures should be free;
- Representatives of affected people should be part of the committee deciding how to respond to grievances;

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- A third party should be available in case certain grievances cannot be resolved - this third party should be neutral, well respected and agreed upon by both AES Sonel and affected parties; and
- Where possible, grievances should be resolved through facilitation rather than arbitration.

Use Consultation as a Monitoring Tool

Despite good planning and good mitigation things can go wrong. Consultation will be used to determine the reasons for problems arising or grievances aired and how the project can be improved. It is also a good way to measure success, as key indicators will emerge.

8.8 MONITORING AND EVALUATION

The monitoring plan should be simple to use and effective in measuring the progress of any given mitigation measure.

As the effects of resettlement can persist long after the construction of the project the evaluation and monitoring of the RAP is a crucial element. Small-scale sample social assessments or discussions with those resettled may be required 6 months to a year after the implementation of the RAP and at subsequent regular intervals.

AES Sonel should gather baseline data against which to monitor future progress and to select two or three key indicators. As the most significant impact of the project is land requisition, the principal monitoring activity will involve the implementation of the resettlement action plan and the monitoring of the success of its implementation. Details of this monitoring process will be provided within the RAP (an outline of the RAP monitoring process can be found in the framework RAP in Appendix L). Monitoring should be an ongoing regular process that culminates in an evaluation every six months. The results of this evaluation should feed into the revised monitoring plan for the next 6-month session.

In addition to the RAP monitoring procedures, a general monitoring plan of the key social impact mitigation measures will help to ensure the appropriate measures are being taken.

A summary of proposed monitoring is presented in Table 8.6.1.

8.9 MANAGEMENT STRUCTURE

As the national power provider in Cameroon, AES Sonel has an existing management structure to facilitate control of potential environmental and social impacts. As the Dibamba Power Project will represent a new entity, there are no project specific management structures to set out, and as such this plan provides the framework for the systems that will be put in place within the existing company structure.

When setting up this project-specific management structure the key elements to incorporate are as follows:

- A single named individual will be given overall responsibility for environmental and social matters on site;

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- A staff structure below this individual will be defined in order to control all aspects covered under the plan (e.g. contractors during the construction phase);
- Staff within this structure will be named individuals or identified posts and a clear statement of their responsibilities will be provided; and
- A clear management and reporting pathway will be set out.
- During construction, the management of the implementation of the detailed resettlement action plan will be a critical task. In addition, the activities of the construction crew will need to be carefully monitored with respect to the requirements of the management plan.
- Once constructed, the operation will have a relatively small-scale plant and the line will require minimal maintenance.

Specific organisational arrangements are presented in Table 8.6.1, below. During the construction phase a dedicated community liaison officer should be appointed to consult the affected communities and respond to any grievances that may arise. When the implementation of the RAP commences a more formal management arrangement will need to be established. The RAP itself needs to identify and provide details on the roles and responsibilities of all organisations and individuals who will be responsible for resettlement activities. Typically there would be a **Resettlement Unit** whose members would have specific roles. The sample roles would be:

- *Resettlement advisory group*: This would comprise the project sponsor (AES Sonel) and relevant local government representatives;
- *Resettlement Manager*: Responsible for overall planning, coordination and management of resettlement unit activities and staff;
- *Community Liaison officer*: Responsible for negotiations and consultation with project-affected community groups;
- *Support Services Unit*: Responsible for technical expertise on health, water supply, etc; and
- *Community Resettlement Committee*: These are typically ad hoc bodies within each community of affected people including host communities, if appropriate. They often serve as channels for grievances between communities and the resettlement unit.

Section 8: Social Management Plan

Table 8.6.1: Summary of Social Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Impact	Mitigation	Implementation	Organisational Arrangements	Monitoring
Population and Demographics	Land requisition and resettlement	Resettlement Action Plan (RAP) (Appendix L) in accordance with World Bank OP 4.12 and IFC Performance Standard 5	RAP process as detailed in RAP framework in Appendix L will be followed Resettlement and Compensation to be completed in advance of commencement of construction works	RAP /Resettlement Unit	Monitoring as per RAP outline but also roles and responsibilities of RAP Resettlement Unit
	Loss of cultural property	The beneficiaries/owners of medicinal trees, be they individual owners or community users, they should receive compensation as necessary	Consultation	RAP Unit to manage consultation	Monitor as part of RAP monitoring process
	In-migration during construction and operational phase	An ongoing induction plan to introduce workers to the social and cultural mores of the project area, and behaviour and social interaction between men and women Consultation with local community, including regular meetings with representatives of the local community	Ensure all new employees (including contractors and sub-contractors) receive induction briefing Ensure consultation programme is implemented	Defined responsibilities required, e.g. human resources officer, community relations officer, village representatives	Employees induction programme throughout the project cycle Community complaints register

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Table 8.6.1: Summary of Social Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Impact	Mitigation	Implementation	Organisational Arrangements	Monitoring
Economic Environment	Loss of land	<p>Compensation will be provided within a formalised Resettlement Action Plan for the project as discussed in Appendix L</p> <p>Compensation within the World Bank 4.12 and IFC Performance Standard 5 guidelines needs to be given to those people who suffer loss of land and/or income as a result of the project</p>	Resettlement and Compensation to be completed in advance of commencement of construction works	RAP Unit	<p>Monitoring as per RAP</p> <p>Outline in Appendix L</p>
	Compensation discrepancy through land right disputes	<p>The compensation process will use the World Bank’s OP 4.12 and IFC Performance Standard 5 guidelines, which provide for the compensation of people without legal title</p> <p>Project affected people should be compensated for loss of land, loss of income and potential income</p>	Resettlement and Compensation to be completed well in advance of construction or operation	RAP Unit	<p>Monitoring as per RAP</p> <p>Outline in Appendix L</p>
	Employment opportunities	<p>Establishment of a community development plan for equitable opportunity of economic development to be incorporated into the overall closure plan</p> <p>Preferential recruitment and training policies for local people affected by the project</p>	Measures should include: skills audit and gap analysis of skills available in the local project area	Project Social and Environmental Management team	Monitor implementation of and community complaints register
	Increased National Power Supply	N/A	N/A	N/A	N/A

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Table 8.6.1: Summary of Social Impacts – Mitigation, Implementation and Organisational Arrangements

Issue	Impact	Mitigation	Implementation	Organisational Arrangements	Monitoring
	Economic benefits	Fiscal measures to protect very poor from inflation generated	Tax exemption, micro credit loans	National and local government RAP/Community development team	Monitor as part of RAP monitoring process
Social Services and Infrastructure	Pressure on health facilities	Provision of on-site health first aid centre during construction (See national legislation) The most effective mitigation measure will be good sensitisation about STIs and HIV/AIDS as mentioned in Section 6.3 Use of health centres in Yassa Village	On-site project specific health facilities will be available from the start of construction Consultation, meetings and distribution of information about STIs and HIV/AIDS	RAP Unit's support services unit and community liaison officer	Monitor as part of ESIA
Electromagnetic Fields (EMF)– Community Health	Community Health	Resettlement of properties within the wayleave	Resettlement and Compensation to be completed in advance of physical construction or operation	RAP Unit	Monitoring as per RAP Outline in Appendix L