TRACTEBEL Engineering
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UPDATE OF THE ECOWAS REVISED MASTER PLAN FOR THE GENERATION AND TRANSMISSION OF ELECTRICAL ENERGY

Final Report Volume 3 : Investment program development and priority project implementation strategy

Economic Community
Of West African States

Communauté Economique
Des Etats de l'Afrique de l'Ouest

General Secretariat / Secrétariat Général

WEST AFRICAN POWER POOL (WAPP)

October 2011

Final Report Volume 3: Investment program development and priority project implementation strategy

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1. INTRODUCTION

This report constitutes Volume 3 of the Final Report of the "Update of the ECOWAS Revised Generation and Transmission Master plan".

The Final Report is composed of the following parts:

Volume 1: Study data

Volume 2: Optimal development plan and Analysis of transmission network performances and stability

Volume 3: Development of the investment plan and strategy of implementation of the priority projects

Volume 4: Synthesis of the report

1.1. Context

The system of the Western African Power Pool (WAPP) which is a specialized institution of ECOWAS constitutes the institutional framework of the regional electric system. The strategic objective of the WAPP is based on a dynamic vision of the integration of the operation of the national electrical communications in a unified regional market. This unified regional market must make it possible to ensure in the medium and long term an electricity supply, which should be optimal reliable and at an accessible cost for the populations of the various Member States.

The objective is to aim at the collective economic good, thanks to a long-term co-operation in the energy sector and with the development of the transborder exchanges of electricity.

The purpose of the present study is to update the regional plan of production and transport for submission to the General Secretary of the WAPP and to the different electric sectors of the Member States.

The aim of the study is, considering the context, to make it possible for the various actors of the sector of electricity to have a clear, total and coherent vision of the future development of the infrastructures of electricity production and transmission in the area and a rational base of decision making for their implementation.

This update of the master plan aims at integrating the developments in hand in a strategy of expansion into the medium and long terms of the regional infrastructures of production and transmission, staying always coherent with the vision of the WAPP.

1.2. Structure of Volume 3 of the Final Report

This Volume 3 of the Final report describes the third phase of the study devoted to the development of the investment plan and the strategy of implementation of the priority projects.

Former Volume 2 had described the development of the Optimal development plan and Analysis of transmission network performance and stability

The economic analysis had highlighted the necessary national investments of production in each country, a list of regional priority projects of production and a list of regional priority transmission projects.

Moreover, the analysis of the transmission network performances and stability of the different WAPP Member States had made it possible to determine the impact of the technical constraints on the list of the priority projects drawn up previously. It had thus highlighted in particular a series of investment and/or additional reinforcements necessary to guarantee the security and performance criteria as well as the stability of the interconnected system.

In order to refine the already released priority list of investments, this report analyses the other impacts that could modify this list (for the environmental, financial or institutional aspects). It also studies the strategy of implementation of these projects.

This report includes the following parts:

Chapter 2: presents the environmental analysis of the priority interconnection and production projects;

Chapter 3: presents the financial analysis of the concerned electrical projects and/or companies and assesses the impact of these aspects on the priority list of projects.

Chapter 4: studies the strategy of implementation of priority projects. This chapter tackles, on the one hand, the approaches followed in existing projects, and on the other hand the strategy of implementation of new projects; It also considers the barriers which can affect the implementation of the priority projects from the perspective of the organization and the legislation in force in the electrical sectors of the Western African countries.

Chapter 5: presents the list of priority regional projects taking into account all the aspects studied previously in the study as well as the conclusions and recommendations of the study.

Chapter 6: presents the environmental improvements brought by the master plan compared to the present situation of electrical energy production in West Africa and shows how renewable energies were integrated in the master plan.

2. ENVIRONMENTAL ANALYSIS

2.1. Introduction

For each Member State, the list of production and transport projects was analyzed globally according to the potential impact that the project can have on the environment and the society.

The very positive impact that these projects can have, by improving the access to electricity for the large majority of the urban population of the concerned countries was not taken into account.

The potential impact on the environment and social issues was the subject of a first evaluation depending on the characteristics of the project, the environment, the establishment and the results of the studies of the studied projects.

2.2. Environmental analysis method

The consultant used a matrix method to evaluate the impacts of the various projects. The criteria are presented in the table hereafter.

Appreciation criteria of impacts, symbolism and qualification

Quality of the effect	**P** **N**	Positive Negative
Importance	**mi** **me** **Ma**	Minor Medium Major
Probability of occurrence	**c** **p** **i** **n**	Certain (inevitable) Probable Improbable Not known
Type	**Di** **In**	Direct Indirect
Duration of the effect	**T** **L** **P**	Temporary Lasting but not permanent Permanent (irreversible)
Appearance time	**Im** **Sh** **Me** **Lo**	Immediate Short term Medium term Long term

NF: if there's no effect or if the effects are taken into account somewhere else.

FM (for memory): if the effects don't have object.

The various aspects taken into account for the projects are summarized hereafter.

The activities at the time of the realization of a line are generally divided in three phases. Namely:

- the preparation phase
- the construction phase
- the operation phase

During the **phase before works** or **the preparation phase**, the undertaken activities are:

- the realization of various studies (technical, of environmental impact, social impact,…);
- topographic surveys and of signposting;
- the clearing and pricking of the line;
- clearing of undergrowth, the pruning or the demolition of certain trees.

The activities **of the construction phase** are:

- installation of building site;
- work of scouring, search and excavation;
- scouring, the clearing and the embankment;
- construction, the adaptation or extension of the transformer stations;
- the deforestation and the opening of the influence;
- the construction of the track of access;
- the construction of the electric line with work of masonry and assembly of the electric components;
- The disassembling of the building sites and evacuation of waste.

The operation phase comprises two activities:

- the constituent of operation of the network in load;
- the constituent of maintenance of the network which includes the maintenance of the line, of the transformer stations that it connects and of the track.

The activities at the time of the realization of a hydro-electrical work are generally divided into three phases. Namely:

- the preparation and deforestation phase
- the works construction phase (dam, tunnel, room of the turbines, outfall, station,…) ;
- the operation phase

During the **the preparation phase**, the undertaken activities are:

- the realization of various studies (technical, of environmental impact, social impact,…);
- topographic surveys and of signposting;
- installation of a life base

The activities **of the construction phase** are the following:

- the construction of the track of access;
- installation of building site;
- deforestation of the a part of future lake area;
- the displacement of the populations;
- work of scouring, search and excavation;
- the opening of quarries and mines;
- scouring, the clearing and the embankment;
- the construction of works;
- the commissioning;
- The disassembling of the building sites and evacuation of waste.

The operation phase comprises two components of activities:

- the constituent of use (treatment by turbine action);
- the constituent of maintenance which includes the maintenance of the works, the line, the road, of the equipment.

The dismantling phase is not taken into account in this study.

2.3. Environmental studies of interconnections

2.3.1. Inter-states projects suggested by the economic and technical analyses

In the frame of this study, on the client's request, the Consultant focused in priority on regional and international projects whose responsibility should be taken by the WAPP. Other projects were also taken into account but were investigated in a lesser extent.

For the lines layout, the options taken into account are:

- Avoiding at maximum the protected areas,
- Following preferably existing infrastructures (HV lines, roads or railways)
- Avoiding passing above villages.

Detailed studies will have to confirm these choices but as a first approximation, it permits a first estimate (according to our matrix) of potential impacts of this project and of particular preoccupations to take into account.

2.3.1.1. 330 KV MEDIAN BACKBONE PROJECT (NIGERIA – GHANA)

2.3.1.1.1. Project Description

This 330 kV interconnection would link Kaindji (Nigeria), where a hydro site is located, to Yendi (Ghana) passing through Bembereke (Benin) and Kara (Togo). It would be expected for 2020.

An alternative layout is to pass via Parakou (Benin), instead of Bembereke (Benin).

2.3.1.1.2. Project Justification

This project is justified to reinforce the network and evacuate the power produced by Nigeria (Kaindji site and gas production) towards the northern zones of Ghana, Togo and Benin, presently importing energy.

Nevertheless, the project needs detailed specifications and studies. Similarly, it would be more logical to extend this line up to the 330 kV axis crossing Ghana from North to South.

2.3.1.1.3. Considered layout

To have a first evaluation of the project impacts on the environment, the Consultant developed a preliminary layout presented on the figure here below.

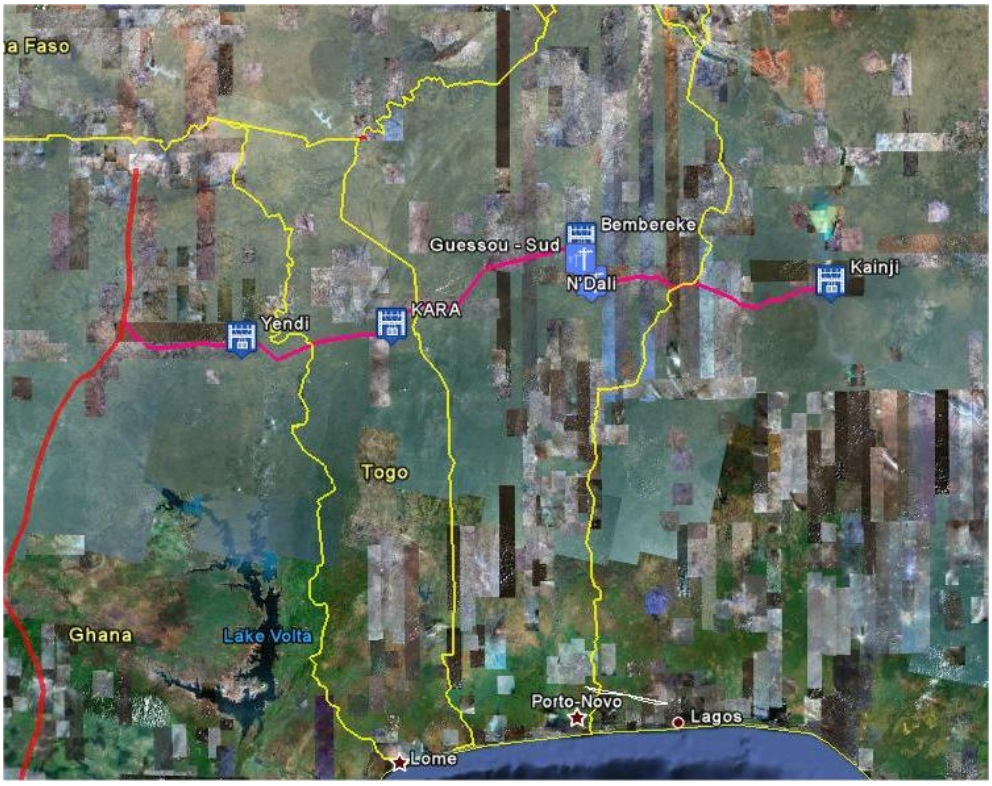


Figure 1: Line layout

Figure 2: Locations of zones with special status (Kanji – Kara)

Figure 3: Locations of zones with special status (Kara - Tamale)

The length of the line is 713 km (608 km if the layout stops in Yendi (Ghana)). The crow-flight distance would reach 633 km.

This layout can be divided in 9 parts, presented hereafter:

The line begins by following the road crossing agricultural zones (6 km).

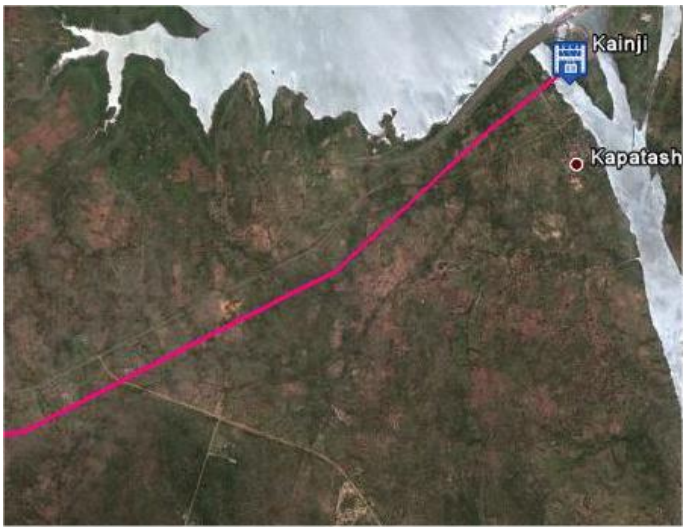


Figure 4: Beginning of the line - Kainji

The second part goes through zones of savannah and agriculture. The line crosses a river (22.5 km).

Figure 5: Second section in the vicinity of New Bussa

Then it joins the Wawa – Kajama road and follows it. It is a zone of agriculture (40 km).

Figure 6: Section along the Wawa - Kajama road

The layout quits the main road and follows a path in zones of agriculture and savannah.

The line passes in the south of zones with special status like Doro (*Forest Reserve*), Borgu (*Forest Reserve*) and Kainji Lake (*National park*) (59.2 km).

Figure 7: Section crossing zones with status

The layout follows a path along the border before the road (RN6) up to N'Dali where it joins an existing line towards Bembereke.

The line goes around the villages. Vegetal units ran across by the line are made of savannah, fallow and cultivation areas. Cultivation areas are agro-forest wherein many types of trees are left standing, mainly those with a directly exploitable production. Some forest ranges are low exploited, particularly in the area close from the border (134 km).

Figure 8: Section in the vicinity of Nikki

From Bembereke to Kpéré, the layout follows a path then crosses a plateau up to RN 6 road, at Kpéré (89 km).

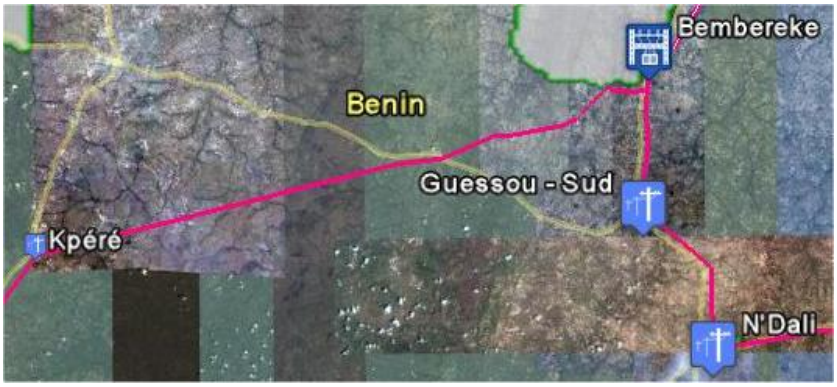


Figure 9: Section in the vicinity of Kpéré

From Kpéré to Yendi, the layout follows the road on all its distance. Population is quite dense but if the layout was slightly moved, very few houses would be impacted.

The occupation of the ground remains dominated by cultivation and fallow areas, with little productive trees (245 km).

Figure 10: Section close to Kara

From Yendi to Tamale, where the line joins the 330 kV North-South axis, the line follows the road. The layout passes south from two registered forests, following the road on all its distance. The population is quite dense. If the layout was slightly moved, few houses would be impacted.

The occupation of the ground remains dominated by cultivation and fallow, with little productive trees (115 km Yendi – Tamale).

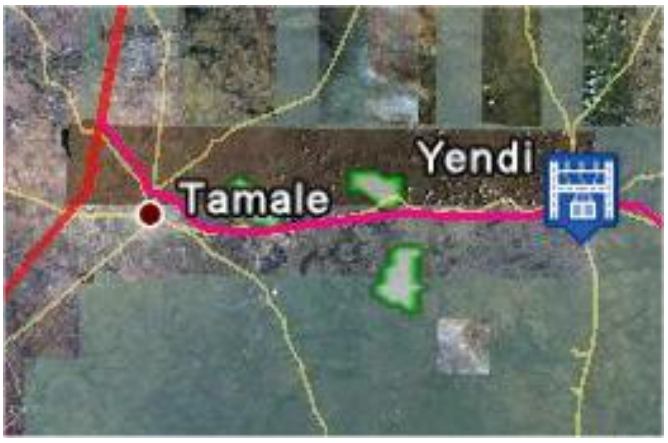


Figure 11: Section close to Tamale – end of the line

2.3.1.1.4. Environmental description

On the whole layout, the line crosses alternatively plateaus and small valleys.

The types of ground occupation under the line corridor are dominated by mosaics of savannah, fallow and cultivation with some remains of degraded forest areas. The plots of land are of the "slash and burn" type where only useful species of trees (fruit production, condiments, fodder for animals, shade,…) are left standing

The natural formations are of two types:

- water bottom land and hydro-physical vegetation,
- fragments of forests galleries along small rivers.

No protected area is crossed by the project. For ecologically sensitive sites, no conclusion can be drawn from the study. Two watercourses will have to be passed through.

The usual fauna met in these ecosystems is little diversified, because of the man pressure on its environment.

2.3.1.1.5. Population

The population density met along the line is presented on the next figure.

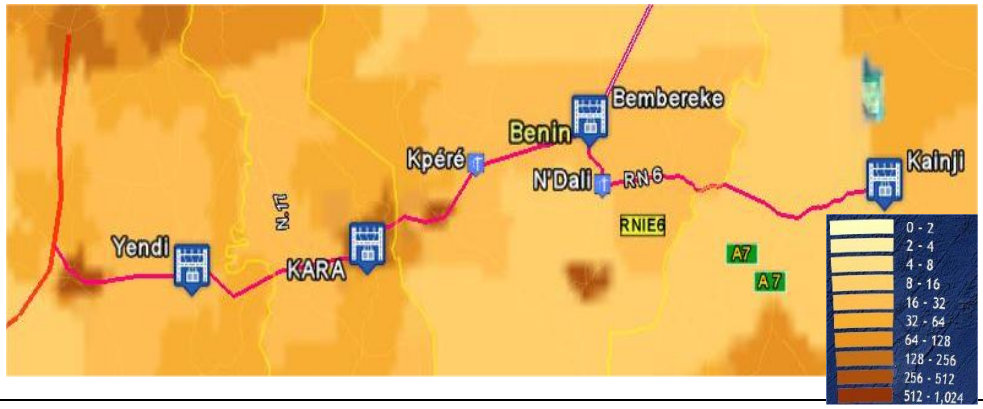


Figure 12: Population density along the layout.

The zone crossed in Nigeria has a low density of population (below 25 inhabitants/km²). It is mainly composed of rural villages. In Benin, the population density is between 25 and 50 persons per km², on the majority of the layout except around the city of Djougou, in the Donga department, where it rises up to 100 -250. The line will have to go around the city.

From Djougou to Kara, in Togo, we stay in a zone with low density (between 50 and 100 persons per km²). The population seems to be located in towns and villages, along the roads. The line will have to follow these axes, at a certain distance, to avoid passing above houses.

After Kara, the density decreases and drops back to 25-50 persons per km² to go through a more populated area after passing the border with Ghana.

Then, there is again a low populated area before reaching the city of Tamale, which is quite populated, as Djougou (between 100 and 250 inhabitants/ km²).

2.3.1.1.6. Project Impact

We present here below the global potential impact of the project as it can be estimated so far and according to the information collected. Detailed studies will have to confirm and refine the impact and the measures to be taken to further reduce them.

The symbols used are presented in the methodology and the explanations on the retained choices are given after the table.

Impact on:	Studies and preparation	Construction	Presence and utilization
Micro climate and air quality	X	N, mi, p, Di, T, Im	x
Grounds and underground waters		N, mi, p, Di, T, Im	x
Surface waters		N, mi, p, Di, T, Im	x
Vegetation	N, mi, c, Di, L, Im	N, Ma, c,Di, P, Im	
Fauna			N, mi, c, Di, L, Im
Population (moving)	x	N, Me, c,Di, P, Im	
Socio-economy	N, mi, p, Di, T, Im	N, mi, p, Di, T, Im	P, Ma, c, Di, P, Im
Visual	x	N, mi, p, Di, T, Im	
Health and security	x	N, Me, c, Di, P, Im	N, mi, c, Di, L, Im

2.3.1.1.7. Micro climate and air quality

Little impact is foreseen except for the rejections of works machineries during the construction phase, because we are in a zone with a good pluviometry and the clearing of dust will be limited.

2.3.1.1.8. Grounds and underground water

Little impact should be observed during the works, except for local erosion phenomena during the rainy season. After, since a grassy cover will probably remain, erosion under the line should not be a threat. For what concerns the ground pollution, if the entrepreneur manages the works properly, there are no important risks.

2.3.1.1.9. Surface waters

The passing of a certain number of backwater can involve some local impacts during construction, but of no importance and controllable. The line presence should not have any influence, neither on the water quality, nor on the water flows.

2.3.1.1.10. Vegetation

The line goes mainly (more than 90%) across fallow and cultivation areas. The rest consists in few forest galleries along small watercourses, peri-urban areas and wooden areas (probably former fallow). The impact will be non negligible in terms of trees to cut down. However, it does not concern high-value trees regarding biodiversity, but only trees with a socio-economic value because they are mainly species whose production is of interest for the population.

2.3.1.1.11. Fauna

Considering the presence of numerous cultivations and human activities, wild fauna is probably limited and represented mainly by an avifauna, small mammals and reptiles. The impact will not be too important in the absence of sensible or rare fauna. A certain number of accidents are to be expected in the beginning of the line presence.

2.3.1.1.12. Socio-economic impacts

- **Impact on the population density**

Observing the proposed layout in detail, it appears that it will be possible to avoid passing above houses. Nevertheless, around cities and important villages, a risk exists to be forced moving some houses, especially close to the border between Benin and Togo. Similarly, between Ketao (Togo) and Kara (Togo), because of the topography and with the eventuality that the line remains in the valley, the risk of passing above house has to be taken into account.

The impact on the population moving will be considered as moderate, but a detailed study is nevertheless mandatory

- **Economic impact**

The line will have to occupy a surface of 4.872 hectares (i.e. 713 km x 60 m). On these 4872 ha, 180 will be fenced to protect the pylons (based on an assumption of 2000 pylons, or an average spacing of 356 m).

Many trees will also have to be cut down, but the exact number is unknown. It will mainly concern species of economic interest. It can be concluded that the economic impact for the villages close to the line will be negative but moderate.

During the study phase, the topographic taking down and the line pricking can have a negative impact if measures are not taken to avoid the destruction of cultivation.

The construction phase should offer some work opportunities with an important positive impact.

We will note the studies and construction impacts will globally be negative but moderate

The use of the line will be very positive for importing countries (Togo, Benin, Ghana) supplying energy at a more interesting marginal cost. Impact can then be retained as major and positive but it will not benefit to the populations experiencing the negative impacts.

2.3.1.1.13. Visual impact

The construction and presence of the line will certainly have a visual impact. The topography of the crossed areas should not make this impact too important except in the area of Bembéréké and Kara where there are hills (granitic ranges). If the line passes by these hills, the visual impact can be important.

For what concerns the visual impact along sensitive sites (historical, natural …), the Consultant could not take these aspects into account in the frame of the study.

2.3.1.1.14. Health and security impact

During the works, accidents are likely, and the line construction impact must be considered as negative to moderate. A good prevention will be necessary for workers and population.

The line presence also has a negative impact (minor) in terms of health, because if the pylons are not correctly protected, there is a risk of accident (fall, electrocution …).

The effects of electromagnetic waves are not considered as harmful because we lack evidence of this harmfulness, as long as houses under the line are moved to an appropriate distance.

2.3.1.1.15. Conclusion

The project does not generate major environmental problems because the layout is drawn in areas where men have already exerted a strong influence on the environment.

2.3.1.2. OMVG-OMVS INTERCONNECTION

The OMVG project (decided project) is composed of a 225 kV interconnection line traversing Guinea, Guinea Bissau, The Gambia and Senegal to share the production of the hydroelectric sites of Kaleta and Sambangalou. The commissioning is planned for 2017.

The OMVS project is envisaged with the commissioning of the hydroelectric site of Gouina (decided project, expected commissioning for 2015). The reinforcement of the 225 kV towards Dakar will be needed. A loop inside the country via Tambacounda is envisaged to also permit the connection with the OMVG network.

To reinforce both networks (OMVG-OMVS), two alternatives are considered. The first one would link Kayes (Mali) to Tambacounda (Senegal) and the second one, between Manantali and Linsan, would permit to connect the projected dams on the Guinean territory: Gourbassi, Bourea and Koukoutamba.

2.3.1.2.1. Kayes – Tambacounda

2.3.1.2.1.1. Environmental description

Figure 13: Overview of the lines and of registered zones

- Zones registered in Senegal with potential impact by the project:

Four registered forests are concerned by the interconnection: Goudiri Forest, Eastern and Western Bala Forests and Boto Forest. These forests are dominated by arborescent vegetation.

- Zones registered in Mali with potential impact by the project:

The interconnection probably passes through the registered forest of Falémé but we couldn't determine the exact perimeter of this registered forest.

2.3.1.2.1.2. Population density

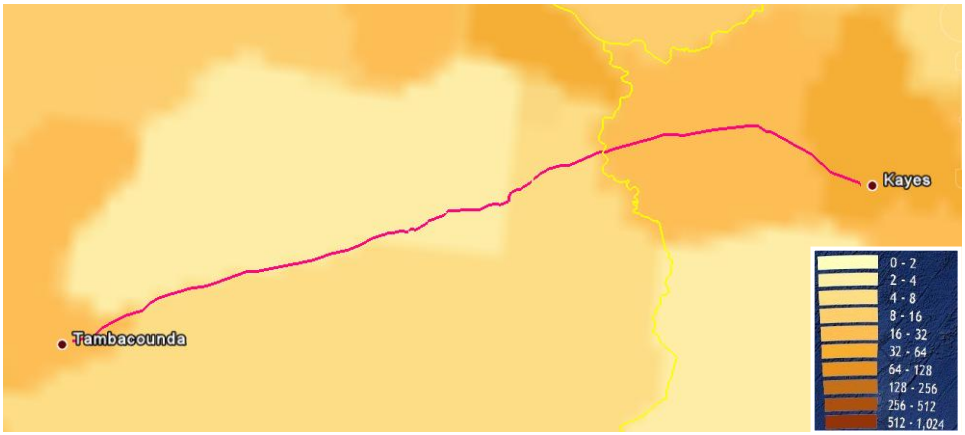


Figure 14: Repartition of population density along the proposed layout

From Kayes on the right, we have:

- 19 km in a population density between 64 and 128 pers/ km² (average value: 96 pers/km²)
- 62 km in a population density between 32 and 64 pers/ km² (average value: 48 pers/km²)
- 25 km in a population density between 4 and 8 pers/ km² (average value: 6 pers/km²)
- 125 km in a population density between 2 and 4 pers/ km² (average value: 3 pers/km²)

- 26 km in a population density between 32 and 64 pers/ km² (average value: 48 pers/km²)

The total distance is 260 km. Assuming it will be 52 m wide on the ground, the project would impact, taking the average values for population density, approximately 350 persons.

2.3.1.2.2. Occupation of the ground

The electrical line starts from Kayes, follows the railway and the main road in a desert region with little vegetation.

Figure 15: Beginning of the line in the vicinity of Kayes

The electrical line then crosses a region with a bit more vegetation and following the railway and the main road to Ambidedi. Agriculture is present in this section.

Figure 16: Section Samankidi - Ambidedi

The electrical line crosses the main road and goes away from it on the next section, but continues along the railway. With the railway, the line goes across a region where human activity seems to have modified the ground occupation very lightly, except for the presence of paths. It is the registered Falémé Forest. Vegetation is more abundant than before. The road, the railway and the line approach Loulinégoté, still in the same context of ground occupation to go towards Kidira (Senegal).

Figure 17: Section Ambidedi - Koulinégoté

Figure 18: Section Koulinégoté - Kidira

In the region of Kidira, the line crosses the Faléné River. Then it follows the railway across a little inhabited and green area thanks to the irrigated cultivations.

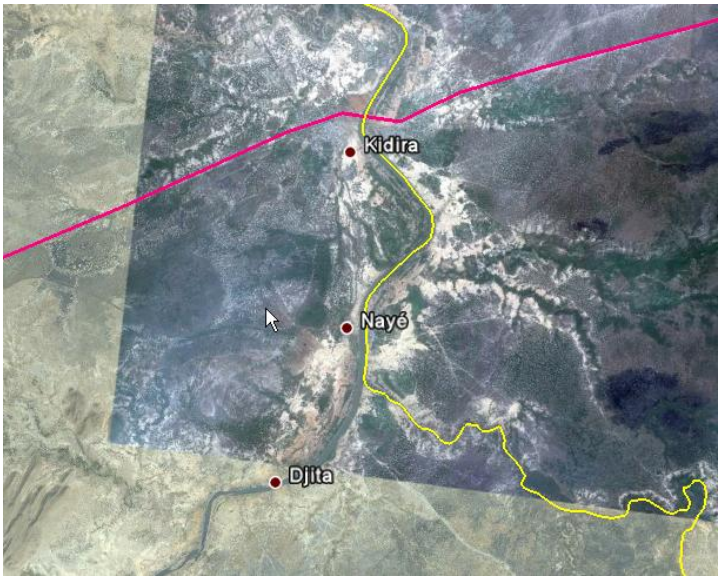


Figure 19: Zone around Kidira

Figure 20: Section to Tambacounda

The line crosses three registered forests: Goudiri, Bala East and Westt, but it follows the railway that also crosses these forests.

Arrival to Tambacounda. Crossing of the registered Botou Forest highly degraded.

Figure 21: Tambacounda and the Botou Forest

2.3.1.2.2.1. Main impacts expected

We present here below the global potential impact of the project as it can be estimated so far and according to the information collected. Detailed studies will have to confirm and refine the impact and the measures to be taken to further reduce them.

The symbols used are presented in the methodology and the explanations on the retained choices are given after the table

Impact on:	Studies and preparation	Construction	Presence and utilization
Micro climate and air quality	X	N, mi, p, Di, T, Im	X
Grounds and underground waters	X	N, mi, p, Di, T, Im	X
Surface waters	X	N, mi, p, Di, T, Im	X
Vegetation	N, mi, c, Di, L, Im	N, Me, c, Di, P, Im	N, mi, p, Di, T, Im
Fauna	N, mi, c, Di, L, Im	N, mi, c, Di, L, Im	N, me, p, Di, T, Im
Population (moving)	X	N, mi, c, Di, P, Im	X
Socio-economy	X	P, mi, c, In, T, Im	N, mi, c, Di, P, Im
Visual	X	N, mi, c, Di, P, Im	N, me, c, Di, P, Im
Health and security	X	N, me, Di, p, In, P, Im	N, me, Di, p, In, P, Im

Micro climate and air quality: Little impact is foreseen except for the rejections of works machineries during the construction phase, and the clearing of dust related to their movements.

Grounds and underground water: Little impact should be observed during the works, except for local erosion phenomena during the rainy season. After, since a grassy cover will probably remain, erosion under the line should not be a threat. For what concerns the ground pollution, if the entrepreneur manages the works properly, there are no important risks.

Surface waters: The passing of a certain number of backwater can involve some local impacts during construction, but of no importance and controllable. The line presence should not have any influence, neither on the water quality, nor on the water flows.

Vegetation: As presented, the line goes through cultivation and fallow areas, arid areas and protected forests (65 km or ¼ of the distance). The rest is constituted of some peri-urban areas, wooden areas (probably former fallows). In terms of uprooting, the layout follows a railway and /or a road on the major part. The impact will consequently be limiter because it would be zone with already existing infrastructures.

Fauna: Considering the presence of numerous cultivations and human activities, wild fauna is probably limited and represented mainly by an avifauna, small mammals and reptiles. The impact will not be too important in the absence of sensitive or rare fauna. There might be a certain number of accidents with the avifauna in the beginning of the line presence. It is important to mention that the line does not seem to be on any bird migration corridor.

Socio-economic impacts:

- **Impact on the population density**

Observing the population density description, the greatest density is in Kayes and diminishes strongly to increase again in Tambacounda. Nevertheless, for cities, a risk of being forced moving some houses or passing above them is to take into account. However, in the countryside, the layout is decided to avoid villages at maximum.

The impact on the population moving will be considered as moderate, but a detailed study is nevertheless mandatory

- **Economic impact**

The line will have to occupy a surface of 1352 hectares (i.e. 260 km x 52 m). On these 1352 ha, 9 will be fenced to protect the pylons (based on an assumption of 650 pylons, or an average spacing of 400 m).

Many trees will also have to be cut down, but the exact number is unknown. It will mainly concern species of economic interest. It can be concluded that the economic impact for the villages close to the line will be negative but moderate.

During the study phase, the topographic taking down and the line pricking can have a negative impact if measures are not taken to avoid the destruction of cultivation.

The construction phase should offer some work opportunities with an important positive impact.

We will note the studies and construction impacts will globally be negative but moderate

The use of the line will be positive with the reliability improvements of the existing networks in Kayes and Tambacounda.

Visual impact

The construction and presence of the line will certainly have a visual impact. The topography of the crossed areas should not make this impact too important.

For what concerns the visual impact along sensitive sites (historical, natural …), the Consultant could not take these aspects into account in the frame of the study.

Health and security impact

During the works, accidents are likely, and the line construction impact must be considered as negative to moderate. A good prevention will be necessary for workers and population.

The line presence also has a negative impact (minor) in terms of health, because if the pylons are not correctly protected, there is a risk of accident (fall, electrocution …).

The effects of electromagnetic waves are not considered as harmful because we lack evidence of this harmfulness, as long as houses under the line are moved to an appropriate distance.

2.3.1.2.2.2. Conclusion

The project will have a low environmental impact because the layout follows existing infrastructures.

2.3.1.2.3. Manantali – Linsan

2.3.1.2.3.1. Environmental description

Figure 22: Overview of the line and protected areas

Protected zones in Mali with potential impact by the project:

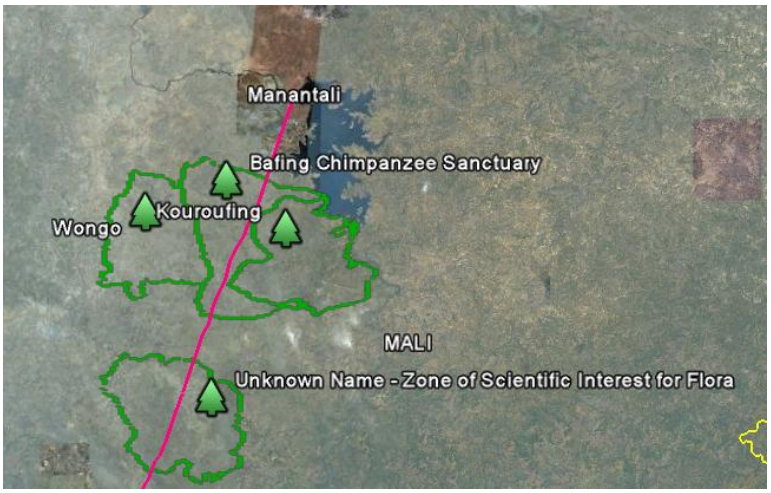


Figure 23: Registered areas in Mali

- Wongo and Kouroufing National Parks

According to the Ministry of environment and sanitation, National Direction of nature conservation, National Forested Policy (2007), the inventory results of the biodiversity resources for the Bafing zone and particularly those of Wongo National Park, Kouroufing National Park and Chimpanzee Sanctuary still present a varied fauna including 993 individuals of mammals belonging to 28 species from 14 families. For birds, there are 619 individuals classified as follows: Wongo (26 species/10 families), Kouroufing (27 species/17 families) and Sanctuary (26 species/16 families).

The area just below is an interesting zone for its flora whose status is presently proposed. For the sake of simplicity, the zone will be integrated in Wongo and Kouroufing National Parks.

Protected zones in Guinea with potential impact by the project:

Figure 24: Registered areas in Guinea

- **Protected area of Bafing Falémé.**

The Fauna Reserve of Bafing was created for compensating the loss of habitat for the fauna caused by the construction of the dam in Manantali achieved in 1988. The reserve was then protected in 1990 and constituted the last Sudan savanna woodlands let relatively intact in Mali (Source Transborder Environmental Diagnostic Analysis of the Basin of the Senegal River – OMVS)

The protected area is on the border with the Republics of Mali and Guinea. With the agreements of both governments, its surface was extended to nearly 25 000 km² where 14 640 km² are in Mali

On a vegetation point of view, savannah characterized by the presence of a herbaceous layer and fire-resistant species (*Combretum sp*. *Vitex sp*., *Ostrioderich chevaleri*, *Landolphia sp*,. *Nauclea sp.*, etc). Dry forests characterized by the weak presence or the absence of sward. They generally comprise only one layer, with many species of light. On the fauna point of view, the surface is characterized by the firm presence of many species of mammals (31 recorded species pertaining to 14 families). This relative richness is reinforced by the presence of more than 58 species of birds. In this reserve, baboons, jackal, wildcat, chive, striped ground squirrel, bushbuck, hippotragus, leopard, hare, porcupine, phacochoerus are present and frequent almost everywhere. Environment and cleaning up Ministry, protected area of Bafing Falémé, Master Development Plan 2006-2016.

According to the study « Transborder Environmental Diagnostic Analysis of the Basin of the Senegal River – OMVS», the importance of the reserve in the biodiversity preservation is better measured knowing that it is the northernmost point in the chimpanzee distribution, an endangered species at international level. The chimpanzees' population is estimated at several hundreds of individuals in 1999, what made it and still makes it on the largest zone of concentration of that species around the world. The Bafing Reserve presents therefore a particular interest in the conservation of wildlife biodiversity.

The threats against this reserve are the extension of the zones of settlement, the increase in the livestock in the surrounding zones and the practice of slash-and-burn agriculture. The creation of a HV line in this reserve will amplify this problem.

- **Protected Area of the Source of Bafing**

Ramsar Site, selected in 2007 of 3172 km² (Source Official Liste Ramsar Site)

- **Protected Area of Konkoure Fetto**

No available information.

2.3.1.2.4. Population density

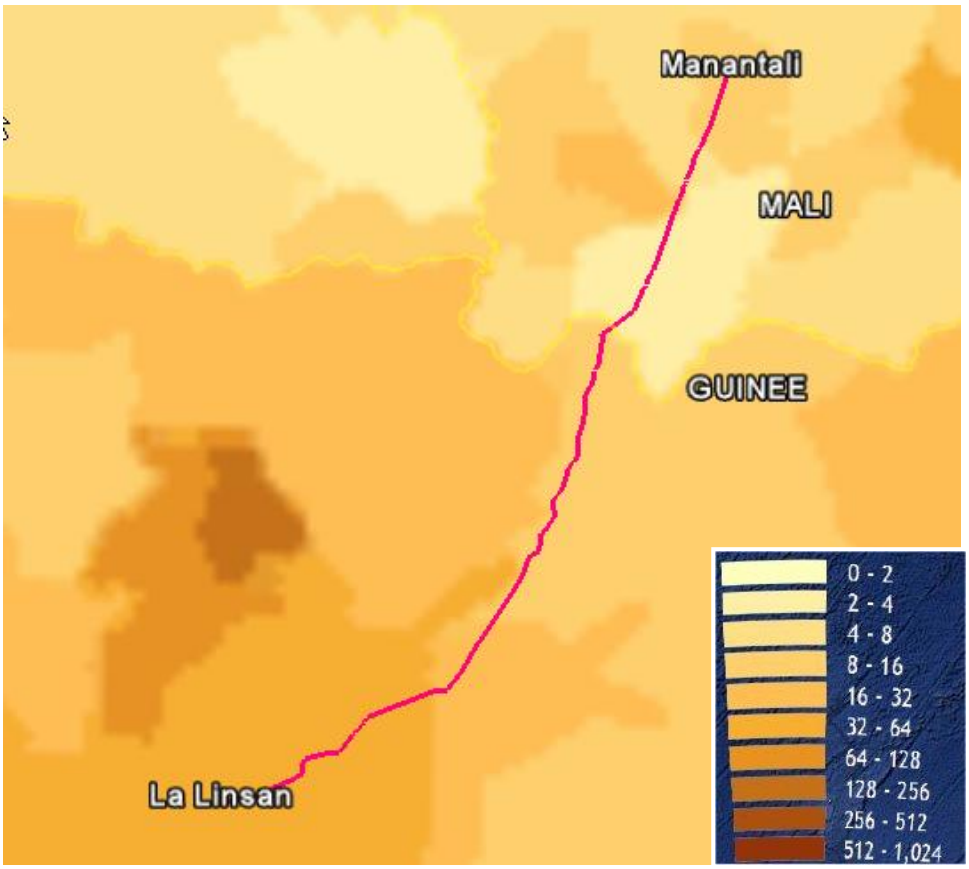


Figure 25: Repartition of population density along the proposed layout

Starting from Manantali in the upper right corner, there are:

- 34 km in a population density between 16 and 32 pers/ km² (average value: 24 pers/km²)
- 25 km in a population density between 8 and 16 pers/ km² (average value: 12 pers/km²)
- 10 km in a population density between 32 and 64 pers/ km² (average value: 24 pers/km²)
- 50 km in a population density between 2 and 4 pers/ km² (average value: 3 pers/km²)
- 132 km in a population density between 8 and 16 pers/ km² (average value: 12 pers/km²)
- 42 km in a population density between 16 and 32 pers/ km² (average value: 24 pers/km²)
- 105 km in a population density between 64 and 128 pers/ km² (average value: 96 pers/km²)

The total distance is 413 km. Assuming it will be 52 m wide on the ground, the project would impact, taking the average values for population density, approximately 810 persons.

Ground occupation

1. Starting from Manantali dam, in a rocky area with little woodlands, few evidence of agriculture exploitation and old stone-pits are noticeable.

Figure 26: Starting from Manantali

2. The line continues in a region where human marks are not really visible. Vegetation is made of sparse bushes. (Picture resolution consequently decreased).

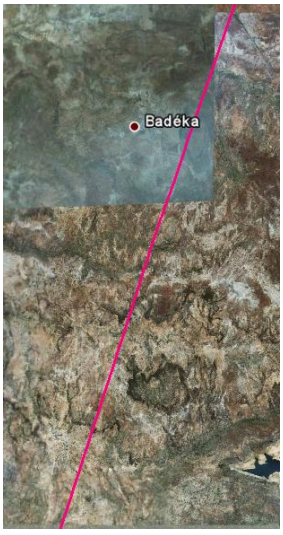


Figure 27: Section along Badéka

3. The layout enters next in the Wongo and Kouroufing National Parks. The parks vegetation is not different from before. There are marks of lands and fallow, nude sides, dense vegetation, some trails, dried watercourses and sparse houses and villages. The line crosses the park over 35 km.

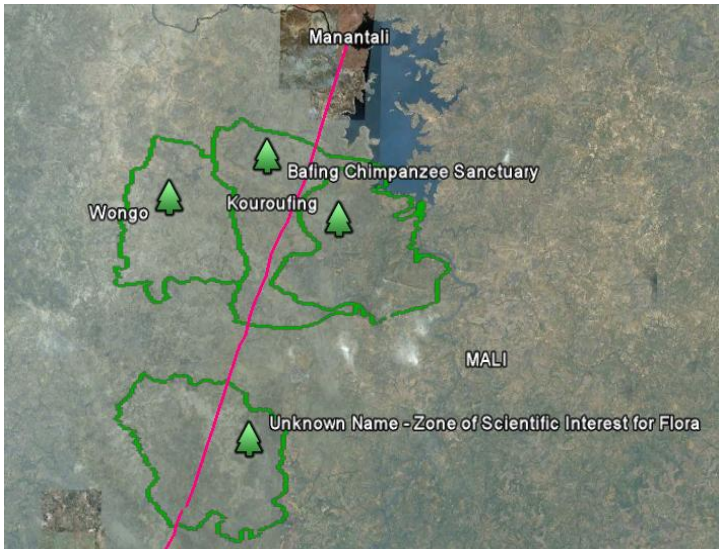


Figure 28: Crossing of protected areas in Mali

4. In Bafing Falémé Park, the line passes through an important water network. The ground occupation remains homogeneous with the one in Wongo and Kouroufing National Parks

Figures 29: Line layout and water network

5. Before entering the zone where the Bafing has its source, the layout meets a rugged ground. One can find dense vegetation (but difficult to notice with the picture quality) and partly bare ground

Figure 30: Section before the Bafing

In this zone, the proposed layout joins and follows a road.

Figure 31: Section in the Bafing Source

6. This ground occupation characteristic continues when crossing the Konkoure Fetto and continues until the end of the end, in Linsan.

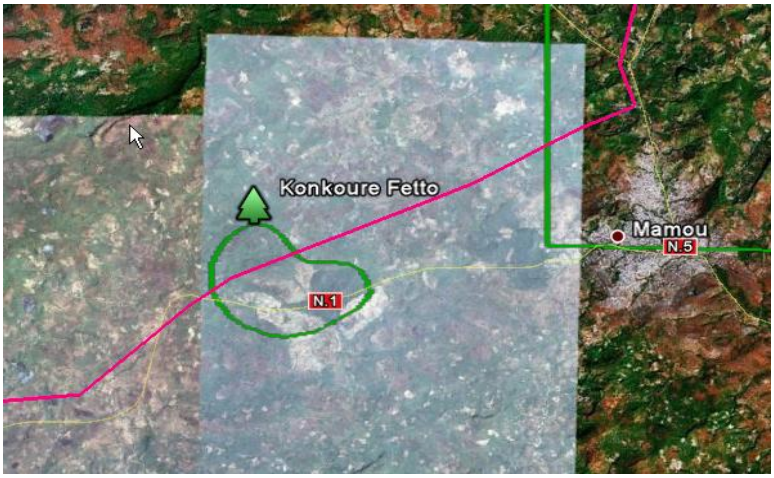


Figure 32: Crossing Konkoure Fetto

Figure 33: End of line in Linsan

7. From Mamou to Linsan, the line follows an existing electrical line. The potential line could follow a longer path than the existing line but the picture resolution can not confirm it.

Figure 34: Section Mamou –Linsan

2.3.1.2.5. Main impacts expected

We present here below the global potential impact of the project as it can be estimated so far and according to the information collected. Detailed studies will have to confirm and refine the impact and the measures to be taken to further reduce them.

The symbols used are presented in the methodology and the explanations on the retained choices are given after the table

Impact on:	Studies and preparation	Construction	Presence and utilization
Micro climate and air quality	X	N, mi, p, Di, T, Im	X
Grounds and underground waters	X	N, mi, p, Di, T, Im	X
Surface waters	X	N, mi, p, Di, T, Im	X
Vegetation	N, me, c, Di, L, Im	N, Ma, c, Di, P, Im	N, ma, p, Di, T, Im
Fauna	N, me, c, Di, L, Im	N, Ma, c, Id, L, Im	N, ma, p, In, T, Im
Population (moving)	X	N, mi, c, Di, P, Im	
Socio-economy	X	P, mi, c, In, T, Im	N, mi, c, Di, P, Im
Visual	X	N, me, c, Di, P, Im	N, me, c, Di, P, Im
Health and security	X	N, me, Di, p, In, P, Im	N, me, Di, p, In, P, Im

Micro climate and air quality: Given the important protected character of the crossed regions, important impacts are foreseen with the rejections of works machineries during the construction phase, and the clearing of dust related to their movements.

Grounds and underground water: Little impact should be observed during the works, except for local erosion phenomena during the rainy season and in rugged areas. Measures should be taken. After, since a grassy cover will probably remain, erosion under the line should not be a threat. For what concerns the ground pollution, if the entrepreneur manages the works properly, there are no important risks.

Surface waters: In this context, the line passes partially in areas where the water network is developed and impacts are expected (backwater,…) during construction. The line presence should not have any influence, neither on the water quality, nor on the water flows.

Vegetation and fauna: As presented, the line goes through numerous protected areas with high ecological value and this on long distances (minimum 250 km, or more than half of the distance). The line implementation would then have non negligible consequences in terms of habitat and vegetal species destruction. Access corridors will be formed by the lines, permitting the trees exploitation (works wood, fire wood, charcoal)

Socio-economic impacts:

- **Impact on the population density**

Observing the population density description, the greatest density is in Manantali and diminishes strongly to increase again at the border and become very high in Linsan. For cities, a risk of being forced moving some houses or passing above them is to take into account. However, in the countryside, the layout is decided to avoid villages at maximum.

The impact on the population moving will be considered as moderate, but a detailed study is nevertheless mandatory.

- **Economic impact**

The line will have to occupy a surface of 2236 hectares (i.e. 430 km x 52 m). On these 2580 ha, 15 will be fenced to protect the pylons (based on an assumption of 1075 pylons, or an average spacing of 400 m).

Given the protected character of the crossed areas, it will be mainly trees with low economic values that will be impacted.

Trees of economic interest will certainly have to be cut down in cultivation areas, and we can then conclude that the economic impact for close villages will be negative though moderate

During the study phase, the topographic taking down and the line pricking can have a negative impact if measures are not taken to avoid the destruction of cultivation.

The construction phase should offer some work opportunities with an important positive impact.

Benefits for local population will be quite low because no line will be set up locally.

Visual impact

The construction and presence of the line will certainly have a visual impact given the topography (hills with 100 m height variations). The rugged topography will shorten the distance between pylons and consequently multiply their number.

For what concerns the visual impact along sensitive sites (historical, natural …), the Consultant could not take these aspects into account in the frame of the study.

Health and security impact

During the works, accidents are likely, and the line construction impact must be considered as negative to moderate. A good prevention will be necessary for workers and population.

The effects of electromagnetic waves are not considered as harmful because we lack evidence of this harmfulness, as long as houses under the line are moved to an appropriate distance.

2.3.1.2.6. Conclusion

It is unadvised to build this line because it passes through several protected and sensitive areas. An interesting alternative would be to replace it by a line between Sambangalou and Manantali or to go via Gourbassi. These lines would avoid the sensitive areas.

A better alternative from the ecological point of view would be the implementation of the orange layout.

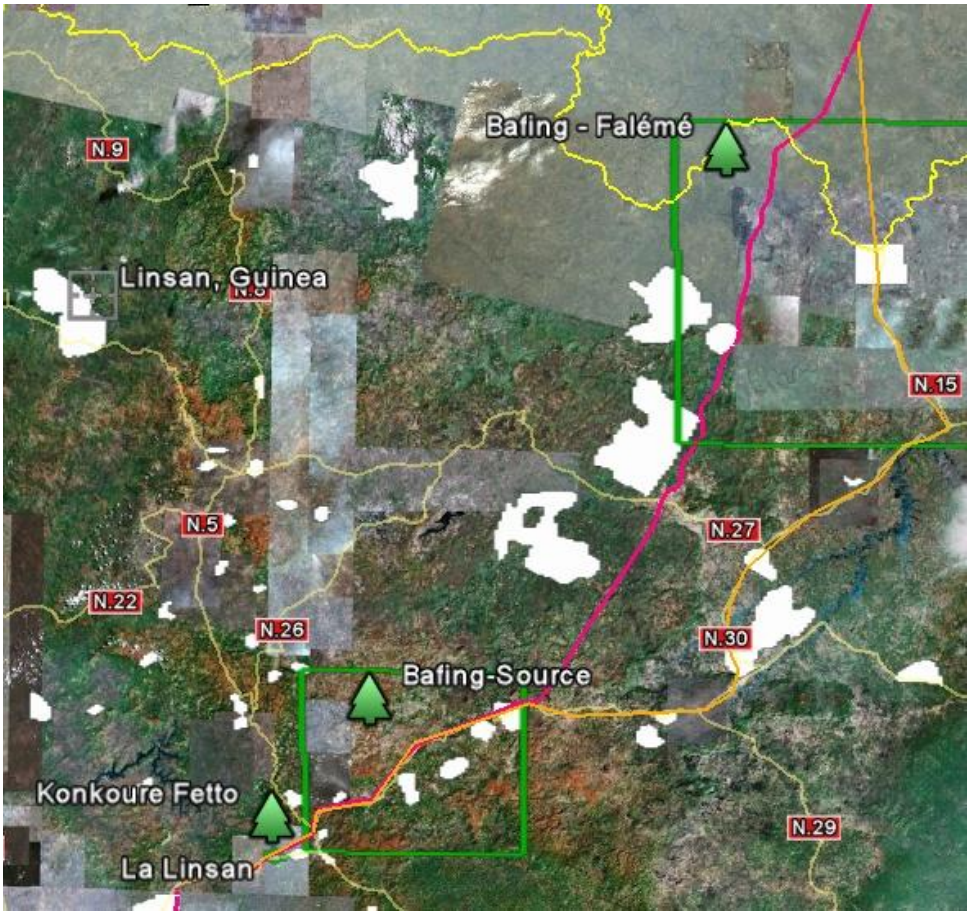


Figure 35: Line alternative

The advantage of this alternative would be to follow the existing routes, reducing therefore the introduction of new impacts on the environment of sensitive zones; the inconvenient would be the increase in length (more than 150 km) and the consequent economic cost increase.

2.3.1.3. 225 KV GUINEA – IVORY COAST INTERCONNECTION

2.3.1.3.1. Project Description

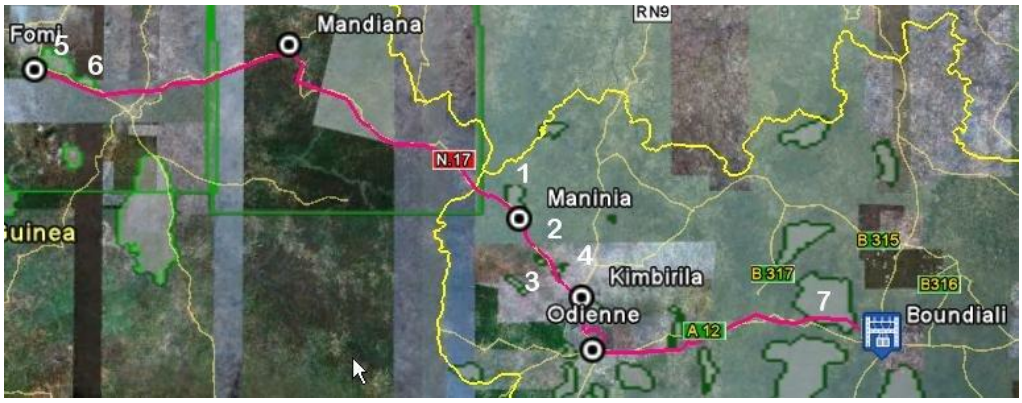


Figure 36: Line layout

The line layout passes along numerous protected forests for which no information could be found. It probably concerns forests that have been protected for years.

The protected forest are Baro (6), Lefarani (6), Tieme (1), Samatiguila (3), Tinrido (2), Kimbiria (4), Tienny and Lapale (7) forests.

The layout will also pass by a humid zones classified as "Ramsar". It concerns « Sankarani-Fié » and «Niger-Niandan-Milo» areas.

« Sankarani-Fié » Area is limited in the east by the republic of Ivory Coast, in the north by the republic of Mali and in the west by the Kankan prefecture, partially covering the sub-prefecture of Sabadoubaranama.

Its vegetation is made of woodland savannah with dry forest. Its climate is dry with temperatures between 22 and 30°C. There are two seasons: the dry season begins in November and ends in May, while the rainy season goes from June to October. It is a relatively flat region with a dense hydrographic network influenced by the dam of Selingue in Republic of Mali, provoking water rises over more that 90 km between Balandougouba and Morodou, provoking huge floods in the plains along the Sankarani.

This confers to the site the first position in term of halieutic production for the natural region of Upper Guinea area.

The site is famous for the particularly good taste of the fishes of the Fié, attracting consumers to the site. A particular research attention on ground, waters and flora quality must be envisaged by the Ramsar-Guinea National Committee in order to identify the specific character of the aquatic fauna of the Fié

The humid area Ramsar "Niger-Niandan-Milo" spreads on a large part of the Kankan and Koroussa Prefectures. It begins from the landing stage of Diolibakoro on both sides of the Rivers: Niger, Milo and Niandan.

It is limited in the north by the Siguiri Prefecture and located inside the Kankan Prefecture, at the borders with the Fodékaria district and its flooding plains on Mandiana side to the protected forest of Gouanankoura towards the Kérouané Prefecture.

On the geopolitical territory of Kouroussa, it spreads to the district of Diareguéla and extends to the south to the plain of Kouya.

Its vegetation is of Guinean savannah type with woods and forests.

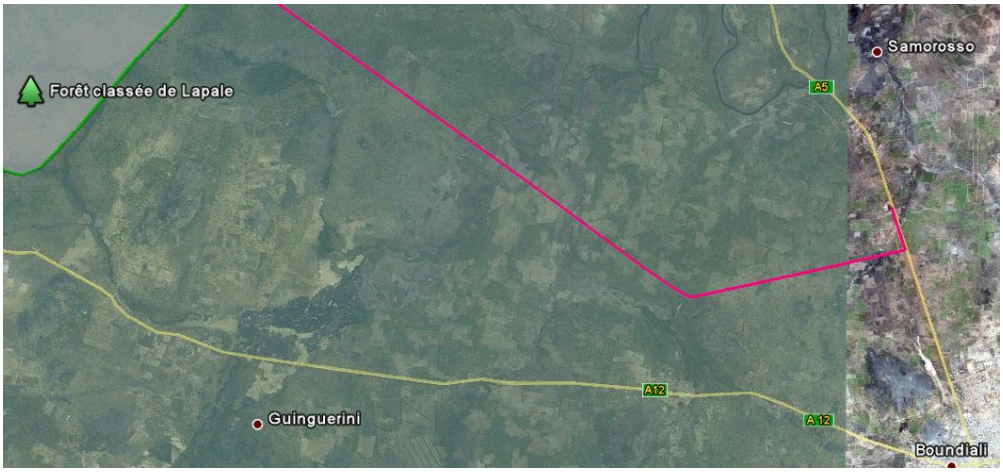
There are among others the protected forests of Léfarani and Baro. Climate is dry with temperatures varying between 28 and 32°C and an average pluviometry of 1300 to 2000 mm.

The topography is flat and gives the site the appearance of an alluvial plain in the middle of which flow numerous sinuous watercourses with the existence of many ponds and pseudo lakes.

The flooding plains reveal a great cultivation and halieutic interest.

2.3.1.3.2. Layout Description

The line would leave Boundiali (Côte d'Ivoire) to go to Fomi (Guinée). It covers 433 km.



The first section follows the existing path taken by the 90 kV line. During the 9 first kilometers, it is mainly in agricultural and peri-urban area. Then for 25 km, it goes through savannah area before entering the protected area of Lapale. It is a zone with marked relief with a mountain range whose highest point reaches 894 meters and is part of the "Denguélé range".

After getting out of the protected area, it runs for 41 km on areas mainly constituted of fallow and cultivation with some gallery-forest along small water courses.

In the neighborhood of Badandougou, it goes again on a marked topography.

After this hilly zone that the line avoids going around by the south, it joins the city of Odienne, head city of the Denguélé region, passing through zones of cultivation, savannah and fallow.

This first section goes through savannahs. This zone is made of a succession of layers of schist rocks giving birth to several types of grounds among which 40% of lithogrounds with a low vegetal and cultivation growth capacity (small depth, little mineral reserve and low water retention capacity). The rest is composed of 56% of ferruginous grounds and fertile vertigrounds (4%) in the bottomland.

The line goes around Odienne and its airport, to reach a road.

The layout goes through a region with savannah, cultivation and fallow.

The layout goes along the protected forest of Samatiguilia, Tinrido and Tienny.

Then, it crosses two Ramsar zones, while going along the road. The area has few marks of cultivation activities and the human pressure seems very low. The bush stratum is little developed and mixes with savannah. The water network is highly developed. The layout ends in Fomi.

2.3.1.3.3. Project Impact

We present here below the global potential impact of the project as it can be estimated so far and according to the information collected. Detailed studies will have to confirm and refine the impact and the measures to be taken to further reduce them.

The symbols used are presented in the methodology and the explanations on the retained choices are given after the table

Impact on:	Studies and preparation	Construction	Presence and utilization
Micro climate and air quality	X	N, mi, p, Di, T, Im	x
Grounds and underground waters		N, mi, p, Di, T, Im	x
Surface waters		N, mi, p, Di, T, Im	x
Vegetation	N, mi, c, Di, L, Im	N, Me, c, Di, P, Im	N, Me, c, Di, P, Im
Fauna		N, Me, c, Di, P, Im	N, Me, c, Di, P, Im
Population (moving)	x	N, Me, c, Di, P, Im	N, mi, c, Di, P, Im
Socio-economy	N, mi, p, Di, T, Im	P, Me, p, In, P, Im	P, Me, c, In, P, Im
Visual	x	N, mi, p, Di, T, Im	N, mi, p, Di, T, Im
Health and security	x	N, Me, c, Di, P, Im	N, mi, c, In, L, Im

2.3.1.3.4. Micro climate and air quality

Little impact is foreseen for the rejections of works machineries and for dust. However, it will be limited.

2.3.1.3.5. Grounds and underground water

Little impact should be observed during the works, except for local erosion phenomena during the rainy season. After, since a grassy cover will probably remain, erosion under the line should not be a threat. For what concerns the ground pollution, if the entrepreneur manages the works properly, there are no important risks.

2.3.1.3.6. Surface waters

During the construction phase, the passing of a certain number of backwater can involve some local impacts during construction, but of no importance and controllable. The line presence should not have any influence, neither on the water quality, nor on the water flows. In the Ramsar areas, a particular attention will have to be given to not impact the water quality during the construction phase.

2.3.1.3.7. Vegetation

The line goes mainly (more than 85 %) across savannah, fallow and cultivation areas. The impact will be small because, though a non negligible number of trees will have to be cut down, it does not concern high-value trees regarding biodiversity. It will concern, above all, trees with an economic interest (Néré, Karité, Mango tree …). The rest is made of gallery forest, peri-urban areas and zones with dry forests and bare ground (probably former fallow). The passage along the old protected forests should have no major impact.

2.3.1.3.8. Fauna

Considering the presence of numerous cultivations and human activities, wild fauna is probably limited and represented mainly by an avifauna, small mammals and reptiles. The impact will not be too important in the absence of sensitive or rare fauna. We also note a minor impact on the fauna due to the line presence because a certain number of accidents are to be expected with the avifauna in the beginning of the line presence.

Nevertheless, in the Ramsar zones, the freshwater fauna is abundant and varied. Impacts during construction could be deplored if no measures were set up. About avifauna, we have no impact, and to be precautious we retain a moderate impact.

2.3.1.3.9. Socio-economic impacts

- **Impact on the population density**

Observing the proposed layout in detail, it appears that it will be possible to avoid passing above houses almost on the whole distance. Nevertheless, around cities and important villages and in region with important relief, a risk exists to be forced moving some houses.

The impact on the population moving will be considered as moderate, but a detailed study is nevertheless mandatory

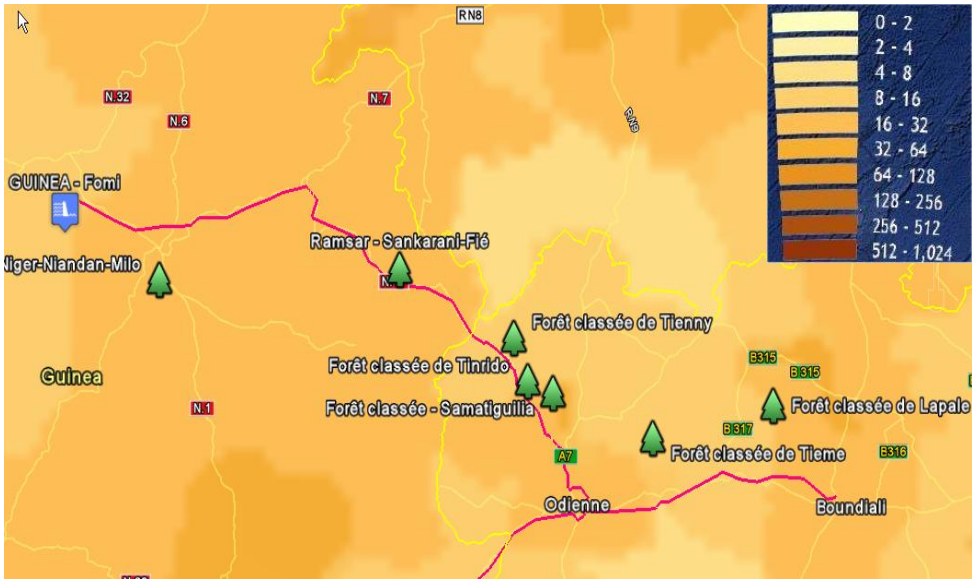


Figure 37: Repartition of population density along the proposed layout

- **Economic impact**

The line will have to occupy a surface of 2252 hectares (i.e. 433 km x 60 m). Among these, 14.4 ha will be under the pylons (based on an assumption of 1000 pylons).

Many trees will also have to be cut down, but the exact number is unknown. It will mainly concern species of economic interest. It can be concluded that the economic impact for the villages close to the line will be negative but moderate.

During the study phase, the topographic taking down and the line pricking can have a negative impact if measures are not taken to avoid the destruction of cultivation.

The construction phase should offer some work opportunities with an important positive impact.

We will note the studies and construction impacts will globally be negative but moderate

The use of the line will be very positive for importing countries (Togo, Benin, Ghana) supplying energy at a more interesting marginal cost. Impact can then be retained as major and positive but it will not benefit to the populations experiencing the negative impacts. Globally, we note it as positive but moderate.

2.3.1.3.10. Visual impact

The construction and presence of the line will have a visual impact. The topography of the crossed areas should not make this impact too important except in the area of important relief where granitic ranges are present. If the line passes by these hills, the visual impact can be important. Given the absence of touristic site, we note it is minor.

2.3.1.3.11. Health and security impact

During the works, accidents are likely, and the line construction impact must be considered as negative to moderate as for other projects.

The effects of electromagnetic waves are not considered as harmful because we lack evidence of this harmfulness, as long as houses under the line are moved to an appropriate distance.

2.3.1.3.12. Conclusion

The line will have a negative impact because it crosses protected areas, and Ramsar zones. However, its layout in these delicate zones follows an existing road on the whole distance. Its ecological cost will then be of small importance and controllable.

2.3.1.4. 225 KV PROJECT MONROVIA (LIBERIA) – SAN PEDRO (IVORY COAST)

2.3.1.4.1. Background

A coastal interconnection between Buchanan in Liberia and San Pedro in Guinea is evoked by the concerned countries.

2.3.1.4.2. Environmental description

Figure 38: Project localization and protected areas

- **Protected zones in Ivory Coast that would be potentially impacted by the project:**

Rapids Grah, protected forest

Haute Dodo, protected forest

These two zones are probably former protected forests that are little protected for now.

- **Protected zones in Liberia that would be potentially impacted by the project:**

Krahn Bassa, National Forest

It is a national forest of 5140 km². In the general report on the inventory of the national forests in Liberia yd M Sachtler in 1968, the forest has an important fauna and flora, notably with elephants (comment: elephants are not quoted anymore in the inventory of species presently available).

According to the « Global Biodiversity Information Facility » (GBIF) site and the World Database on Protected Areas (WDPA), the following fauna species are present on the site: *ahtérus africanus, athlax paludinosus, barbus ablabes, barbus spurelli, barbus trispilos, clarias p, hemichromis bimaculatus, malaperurus electricus, manis tricuspis, papyrocranus sp, perordictius potto, polypterus palmas, thryonomys swinderianus, thryonomys swinderianus.*

Given the age of the document and the evolutions the country experienced these last years, a study should be carried out to evaluate at best the ecological value of the zone.

2.3.1.4.3. Population density

Figure 39: Repartition of population density along the proposed layout

From San Pedro on the right, there are:

- 20 km of urban area with San Pedro and a population density from 64 to 256 pers/ km². The value taken into account is 24, assuming the line is outside the habitation areas.
- 100 km in a population density between 32 and 64 pers/ km² (average value: 48 pers/km²)
- 40 km in a population density between 16 and 32 pers/km² (average value: 24 pers/km²)
- 60 km in a population density between 32 and 64 pers/ km² (average value: 48 pers/km²)
- 120 km in a population density between 16 and 32 pers/km² (average value: 24 pers/km²)
- 20 km in a population density between 4 and 8 pers/km² (average value: 6 pers/km²)
- 60 km in a population density between 64 and 128 pers/km² (average value: 96 pers/km²). It is the city of Buchanan, where the line passes in periphery. The value taken into account is 24 because the line was set outside the living area.

The total distance is 420 km. Assuming it will be 52 m wide on the ground, the project would impact, taking the average values for population density, approximately 700 persons.

2.3.1.4.4. Ground occupation

Starting from the 225 kV substation of San Pédro, the line goes around the town and, when going out of the town, it follows a road entering tin the protected forest « Rapide Grah » and parallel to the coast.

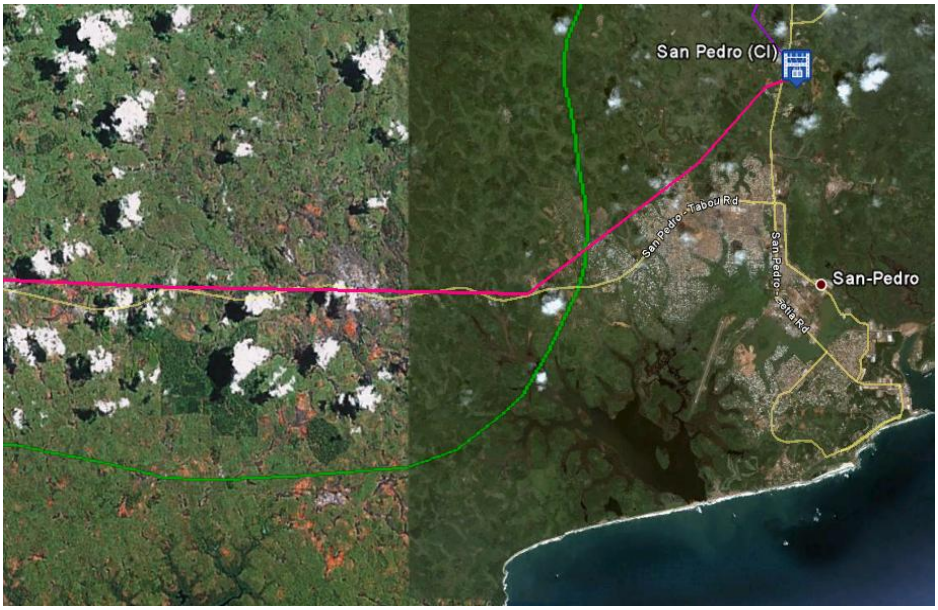


Figure 40: Section around San Pedro – entering "Rapide Grah"

The line could be moved outside the protected areas to avoid conflicts with it. The layout would be in a much more humid zone with mangroves and swamps: technical considerations will have to be adapted to these parameters.

The line goes out of the protected forest« Rapide Grah », still follows the road to cross a small part of the protected forest of « Haute Dodo ». In this part, small marks of human activities are visible (stone-pit?).

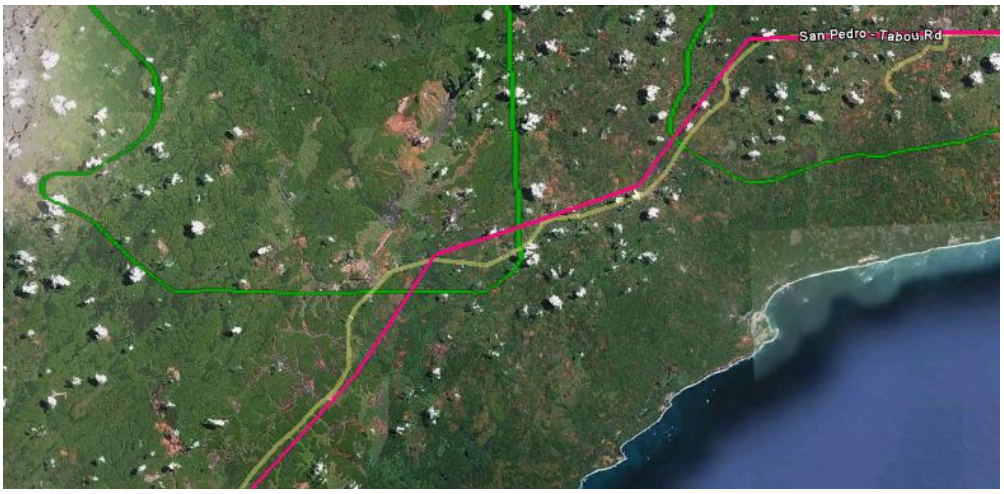


Figure 41: Section in "Rapide Grah" entering in "Haute Dodo"

The line keeps following the road and crosses another dense forest. The line also crosses agricultural exploitation (palm trees, fields, fallow…) at the level of Oulidié and Wéséké.

Figure 42: Section Oulidié - Tabou

From Tabou and then passing the border, the line goes into a region where the water network is very developed. The line still follows the road. The image resolution decreases and it is difficult to detail at best the ground occupation met.

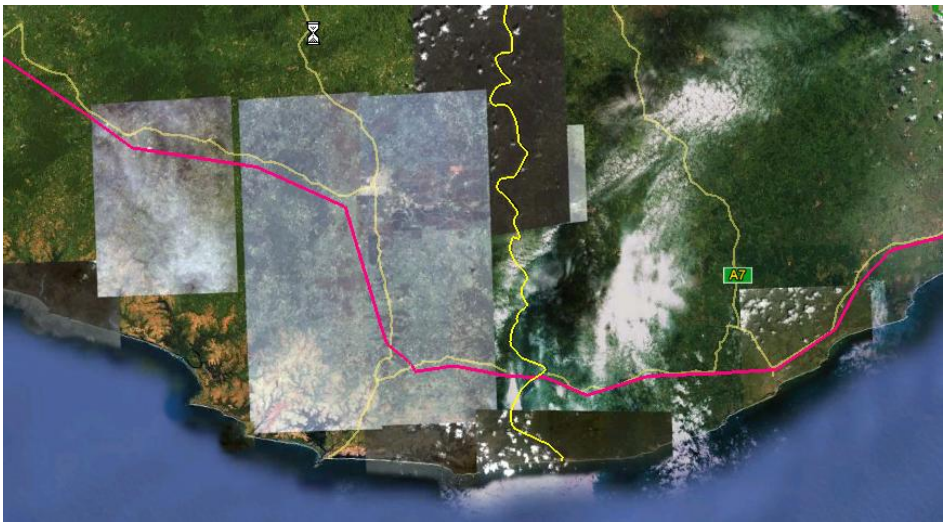


Figure 43: Section between the borders

From Pleebo, the line goes into a dense forest following the road. Clearings due to laterites are visible on the picture. Along the road small villages developed. Marks of human activities are visible (large plantations of palm oil, cultivation and fallow)

Figure 44: Section around Pleebo

The line crosses next a homogenous region mainly composed of forests. The presence of cultures seems less important. The layout is away from the coast to go away from mangroves and swamps highly present and find a land with better access for construction and maintenance of the line. The line does not follow the road anymore.

Figure 45: Section Barclayville – David copo Town

Then the line crosses the protected forest of Krahn Bassa and must go over watercourses perpendicular to the coast, as the Cestos River.

Figure 46: Section across Krahn Bassa

An alternative to this layout would be a line closer from the sea. Then it should rather the de « Cestos Sankwen » proposed for protection, and consider the constraints provoked by a hydro network that is more important along the coast.

Figure 47: Alternative to the crossing of Krahn Bassa

Going out of the Krahn Bassa Park, the line encounters a road. One can distinguish, close from Menyongor a palm oil exploitation crossed by the line.

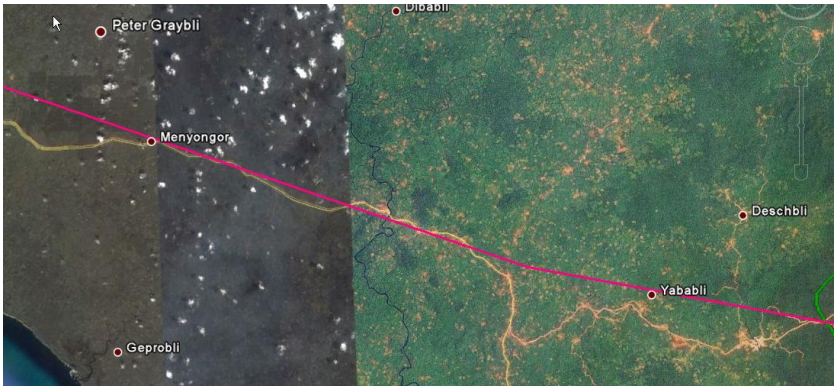


Figure 48: Section from Yababli to Menyongor

The line ends up in Buchanan.

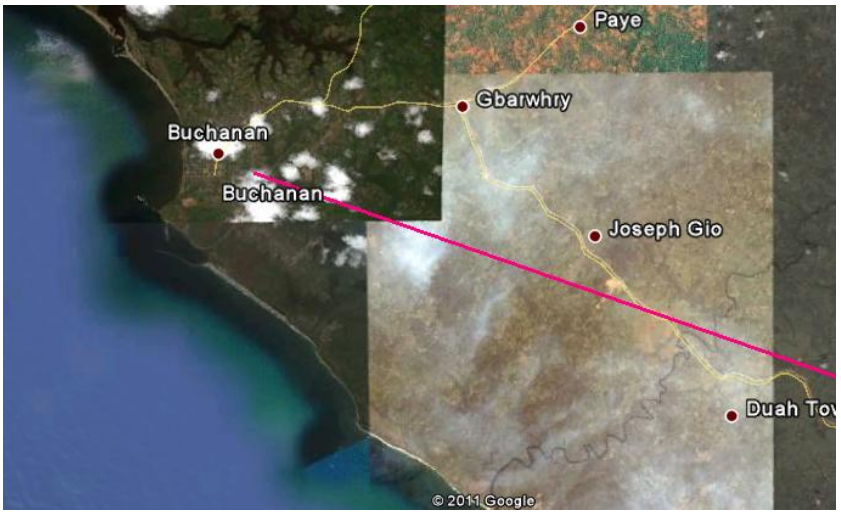


Figure 49: Section to Buchanan

2.3.1.4.5. Main impacts expected

We present here below the global potential impact of the project as it can be estimated so far and according to the information collected. Detailed studies will have to confirm and refine the impact and the measures to be taken to further reduce them.

The symbols used are presented in the methodology and the explanations on the retained choices are given after the table

Impact on:	Studies and preparation	Construction	Presence and utilization
Micro climate and air quality	X	N, mi, p, Di, T, Im	X
Grounds and underground waters	X	N, mi, p, Di, T, Im	X
Surface waters	X	N, mi, p, Di, T, Im	X
Vegetation	N, mi, c, Di, L, Im	N, Ma, c, Di, P, Im	N, mi, p, Di, T, Im
Fauna	N, mi, c, Di, L, Im	N, Ma, c, Di, L, Im	N, Me, p, In, T, Im
Population (moving)	X	N, mi, c, Di, P, Im	X
Socio-economy	X	P, mi, c, In, T, Im	N, mi, c, In, P, Im
Visual	X	N, mi, c, Di, P, Im	N, Me, c, Di, P, Im
Health and security	X	N, Me, Di, p, In, P, Im	N, Me, Di, p, In, P, Im

2.3.1.4.6. Micro climate and air quality

Little impact is foreseen besides the rejections of works machineries during the construction phase and the clearings of dust due to their movements.

2.3.1.4.7. Grounds and underground water

Little impact should be observed during the works, except for local erosion phenomena during the rainy season. After, since a grassy cover will probably remain, erosion under the line should not be a threat. For what concerns the ground pollution, if the entrepreneur manages the works properly, there are no important risks.

2.3.1.4.8. Surface waters

The passing of a certain number of backwater can involve some local impacts during construction, but of no importance and controllable. The line presence should not have any influence, neither on the water quality, nor on the water flows.

2.3.1.4.9. Vegetation

As seen, the line goes through dense forest, among which one is protected (70 km , or 1/6 of the distance), come cultivations (palm oil, fields and fallow…) and great humid zones. Given the important occupation of the dense forest, the uprooting will be important, even though the layout follows partly a road (more or less 250 km); the alternative moving the section to a place where the vegetation is less dense would bring the line construction to much more humid zones with stronger technical constraints.

2.3.1.4.9.1. Fauna

Considering the historical background of the country, the little information collected indicates a fauna that was important in the past (elephants) in the Krahn Bassa park.

However, in the part outside of the protected areas, without more in-depth study and considering the probable lack of a sensitive or rare fauna, the impact will be limited.

2.3.1.4.10. Socio-economic impacts

- **Impact on the population density**

Observing the population density description, it appears that the largest population densities are in San Pedro and decreases strongly to rise back in Buchanan. Inside cities a risk of moving families are passing above houses is to be taken into account. Oppositely, in the forests, the layout can be decided to avoid the villages.

The impact on the population moving will be considered as moderate, but a detailed study is nevertheless mandatory.

- **Economic impact**

The line will have to occupy a surface of 2860 hectares (i.e. 420 km x 52 m). Among these 2184 ha, 15.12 ha will be fenced to protect the pylons (based on an assumption of 1050 pylons, or an average space of 400m).

Many trees will also have to be cut down, but the exact number is unknown. It will not concern species of economic interest. It can be concluded that the economic impact for the villages close to the line will be negative but moderate.

The construction phase should offer some work opportunities with an important positive impact.

We will note the studies and construction impacts will globally be negative but moderate

2.3.1.4.11. Visual impact

The construction and presence of the line will have a visual impact. The quite flat topography should not make this impact too important.

For what concerns the visual impact along sensitive sites (historical, natural …), the Consultant could not take these aspects into account in the frame of the study.

2.3.1.4.12. Health and security impact

During the works, accidents are likely, and the line construction impact must be considered as negative to moderate as for other projects. A good prevention will be necessary for workers and population.

The effects of electromagnetic waves are not considered as harmful because we lack evidence of this harmfulness, as long as houses under the line are moved to an appropriate distance.

2.3.1.4.13. Conclusion

The line will have an important impact on the environment but they still could be controllable.

2.3.1.5. LINE MAMBILLA – MAKURDI (760 KV NIGERIA)

2.3.1.5.1. Project description

Figure 50 : Line layout

The layout starts from the production area and follows roads at first to reach the north of the town of Gembu in order to avoid population.

The line will then follow the road between Rafin Kada and Gembu passing through a zone with rugged ground. Visual impact could be important if no special measures are taken during detailed studies.

Arriving close from Cameroon's border (near Aboe), the layout meets zones where a forest vegetation is degraded. The line will have to follow the road narrowly to avoid any useless cutting-down.

Then, from Abong, the layout arrives in a zone where the ground is less rugged and the vegetation is made of savannah and of forest galleries in valleys.

From Baissa (where we will go around the protected area via the north, the landscape is more and more marked by men and fallows and cultures become more and more present. The landscape stays like this until Makurdi.

On the whole distance, only a small area with protected status is crossed (Kadara area). This choice was made because the road already crosses this zone. It could be avoided easily if necessary.

2.3.1.5.2. Project impact

The potential impact of the project as it can be estimated for now and according to the information collected is presented hereafter. Detailed studies will have to confirm and refine these impacts to propose reduction measures.

Impact on:	Studies and preparation	Construction	Presence and utilization
Micro climate and air quality	X	N, mi, p, Di, T, Im	x
Grounds and underground waters		N, mi, p, Di, T, Im	x
Surface waters		N, mi, p, Di, T, Im	x
Vegetation	N, mi, c, Di, L, Im	N, Me, c, Di, P, Im	N, mi, p, Di, T, Im
Fauna		N, Me, c, Di, P, Im	N, Mo, c, Di, P, Im
Population (moving)	x	N, Me, c, Di, P, Im	N, mi, c, Di, P, Im
Socio-economy	N, mi, p, Di, T, Im	P, Me, p, In, P, Im	P, Me, c, In, P, Im
Visual	x	N, Me, c, Di, P, Im	N, Me, p, Di, T, Im
Health and security	x	N, Me, c, Di, P, Im	N, mi, c, In, L, Im

2.3.1.5.3. Micro climate and air quality

Little impact is foreseen for the rejections of works machineries and dust. However it will be limited.

2.3.1.5.4. Ground and underground waters

Some impact should be observed during the works, particularly at the beginning of the line where the ground is more rugged. After, since a grassy cover will probably remain, erosion under the line should not be a threat. For what concerns the ground pollution, there are no important risks.

2.3.1.5.5. Surface waters

During the line construction, the passing of a certain number of small rivers and backwaters, as well as the passing of two large rivers is to be foreseen. It can involve some impacts, but of no importance and controllable. It is above all the vehicles movements that can cause damages.

The line presence should not have any influence, neither on the water quality, nor on the water flows.

2.3.1.5.6. Vegetation

The line goes mainly (for more than 70%) through fallows and cultures. The impact will consequently be moderate because a non negligible number of trees will have to be cut down but these trees are not of great biodiversity value. They are interesting commercially.

The 30% remaining are composed of forests (at the border with Cameroon), forest galleries, urban areas, dry forests and bare grounds. The passage through the forests can have a non negligible impact and a moderate global impact was consequently retained.

2.3.1.5.7. Fauna

Wild fauna is probably limited and represented mostly by small mammals, an avifauna and reptiles given the presence of numerous cultures and other human activities.

The impact will not be too important given the probable absence of uncommon or sensitive fauna. For what concerns the fauna along the border with Cameroon, we have no information. Consequently, we retained a moderate level by precaution principle.

2.3.1.5.8. Socio- economic impacts

- **Impact on the population density**

Observing the proposed layout, it appears that it will be possible to avoid passing above habitations almost on the whole line distance. The risk of having to move some houses exists only around cities and villages for passing large rivers and in place with rugged ground.

Because the population density is high in the area around Makurdi, we kept a moderate impact level.

2.3.1.5.9. Visual impact

The presence of the line will have a visual impact in the area with rugged ground. It is retained as moderate for the whole project.

2.3.1.5.10. Conclusion

The line will have a negative impact because it crosses areas with rugged ground, highly populated areas, and areas with forests. However, its layout in these delicate areas always follows existing roads. Its ecological cost will consequently be controllable.

2.3.2. Planned Projects

2.3.2.1. NORTHCORE PROJECT (1049 KM)

The project consists in a 330 kV interconnection line between Birnin Kebbi (Nigeria) - Bembéréké (Bénin) – Niamey (Niger) – Ouagadougou (Burkina Faso). The length of the different sections is estimated to:

- 268km between Birnin Kebbi – Niamey;
- 312 km between Zabori (intermediate tapping in Niger) – Bembéréké ;
- 469 km between Niamey – Ouagadougou.

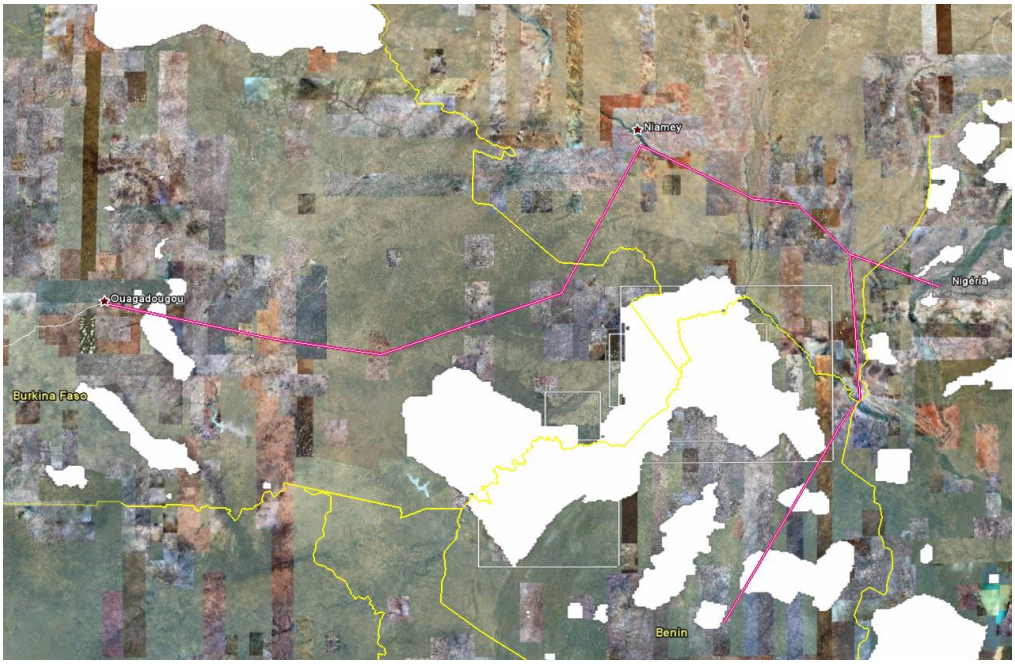


Figure 51: Northcore project with visualization of the protected areas (white)

The impact of the project would be medium in terms of environment because, though it will be long, it does not go through the greatest protected site of the area. For what concerns the protected forest of Nakambé (close to Ouagadougou), the forest is already highly degraded and the layout should follow existing roads.

For what concerns the social impact, the amount of people to move has not been estimated but it will not be null as indicated in the study performed in 2007.

2.3.2.2. 330KV NORTH-SOUTH AXIS IN GHANA

This 330 kV line links the substations of Domini (border with Ivory Coast) and Bolgatanga (border with Burkina Faso) passing through the substations of Kintampo, Techiman, Kumasi and Prestea.

The new line should follow an existing 161 kV line. The impact will then be limited.

2.3.2.3. GHANA-BURKINA FASO – MALI INTERCONNECTION (742 KM)

This 225 kV interconnection foresees to interconnect the substations of Han (Ghana) – Bobo Dioulasso (Burkina Faso) – Sikasso (Mali) – Bamako (Mali). 4 new substations are foreseen: 1 in Ghana (Han) and 3 in Mali: Sikasso, Bougouni and Sanakoroba. The total length of the line is 742 km whose 48 km in Ghana, 298 km in Burkina Faso and 396 km in Mali.

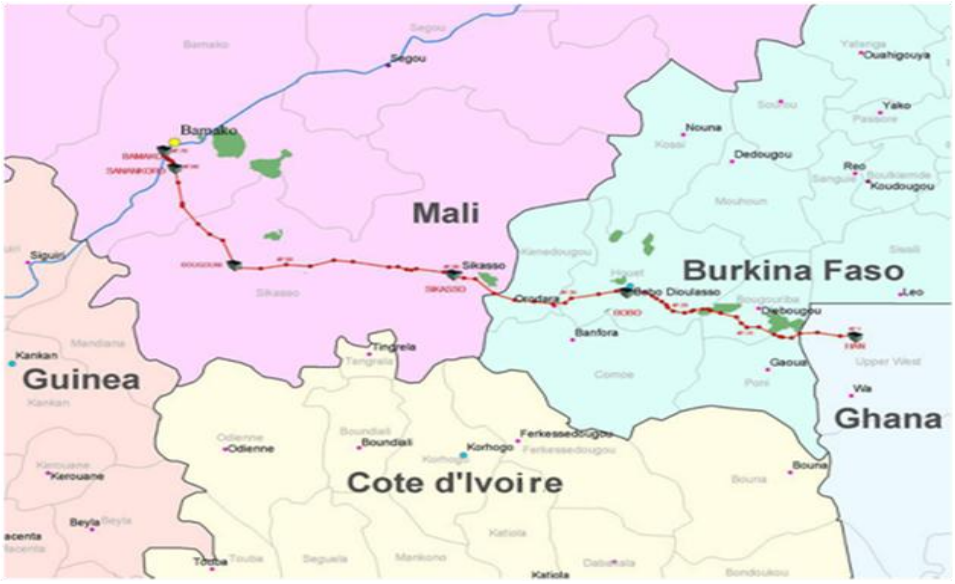


Figure 521: General location of the Ghana-Mali interconnection project

No environmental or social study is available for now. The line should however have a limited impact because it mainly passes along existing roads and only along protected areas. It will need cutting down a lot of trees of commercial use (Mango tree, Néré, Karité, ...) because the majority of the layout is in cultivation area.

Since the 330 kV North-South axis in Ghana was reviewed to follow a layout more on the East towards Bolgatanga, the layout of this interconnection should be reviewed after Bobo Dioulasso to connect Ghana to the substation of Bolgatanga instead of Han. The master plan reviewed recently in Ghana confirmed that this modification was wished to optimize the interconnected network of the area.

2.3.2.4. GUINEA – MALI INTERCONNECTION (920 KM)

The project includes the construction of a 225 kV line of about 920 km between Fomi (Guinea) and Nzérékoré (Guinea) then between Fomi (Guinea) and Bamako (Mali) with the substations of: Nzérékoré – Beyla – Kérouané – Kankan – Fomi – Siguiri (Guinea) – Kodialani (close from Bamako in Mali).

The calls for tender for the environmental studies were released beginning of 2011. Consequently, the consultant could not yet analyze the impact expected for this project.

2.4. Environmental analysis of production projects

2.4.1. Gas turbines and combined cycles

In the various countries of West Africa, the rehabilitations of existing gas turbines are considered. In general, these rehabilitations have a negligible impact on the environment since the sites already exist.

The construction of new gas turbines will have a weak to medium environmental impact, especially regarding the noise and the quality of the air. An example is the site of Maria Gleta in Benin where 8 turbines of 10 MW will be installed. If fuel storages are envisaged (like substitution fuel), the impact of a possible leak will also have to be taken into account.

The fuel change in the existing gas turbines (use of natural gas) will have a positive effect in terms of environment.

Finally, the construction of combined cycles (in Benin and Ivory Coast in particular) must be the subject of thorough studies of environmental impact. The principal impacts which will have to be taken into account are those on the water, the air and the noise.

2.4.2. Coal units

The construction of new coal units is planned in Senegal and possible in Niger. Three types of impacts must be analyzed in detail. It is about the impact of the storage and the handling of coal (dust), which causes air pollution. The impact of smoke, which also causes air pollution and the impact of the cooling cycle which can cause alone a physical, thermal and chemical pollution of surface water.

Regarding the power station of Salkadamna in Niger, a fast analysis is presented further in this report.

2.4.2.1. SALKADAMNA COAL POWER PLANT

The power station of Salkadamna will be located in the area of Tahoua, 80 km in the North-West of Tahoua and 20 km west of the chief town of the rural district of Takanamat.

The area comprises two big zones of relief:

The plateau zone crossed by deep valleys (200 m to the East and 30 m to the West).

The plateau zone East of Madaoua.

The climate of the area is characterized by two seasons: the rain season from June to September and the dry season the rest of the year. The annual average temperature is of 29.2°c (average 1995-2005).

In 2001, the population of the area was estimated to approximately 2.000.000 inhabitants (i.e. a density of 17.6 p/km²). That represents 18% of the total population of Niger. The main ethnic groups of the area are: the haoussas, the tuaregs, the peuhls, the djermas and the arabs. The economy in the zone of the project (departments of Tchintabaraden) is primarily centered on pastoralism. Agriculture remains a marginal activity with the presence of some fields in the lowlands. Some speculations like millet, sorghum and market gardenings can be found there. It is a traditional type of agriculture with negligible productions mainly intended for home consumption. Breeding is the second economic activity of the area. One meets there nomad and migration breeding[1].

Like all the coal units, the impact will be especially due to the air pollutants (dust of the coal stockyard, the handling of coal, flying ashes, smoke, SO2, CO and CO2, NOx, Fluoride, Mercury etc). The impact is especially important on health, the vegetation and the animals. However, considering the weak density of population in the area, it should be possible to control this impact well and to limit it. In absence of feasibility and weather data, it is difficult for us to carry out a first estimate of the future dispersion of dust and smoke, but the feasibility study should determine the height of the chimneys to lay down and the systems of purification of smoke to set up.

A second significant impact on water. The cooling cycle requires a lot of water, and it is a scarce resource in the area. Here too, it is primarily the technological choice of the type of cooling cycle which will be essential to limit the impact. However, a cooling by aerocondenser makes it possible to limit water consumption.

Regarding the production of waste (ashes, clinker, toxic products,…), an impact is possible if the project is not well prepared. These impacts are however controllable by using the recycling possibilities (ashes for cement-manufacturer for example) and of the ways of elimination approved for the toxic products.

2.4.3. Diesel systems

The rehabilitation or the construction of diesel groups should have a small impact the environmental level. The impact will be limited to the air and the noise and no other social impact is expected. Indeed, in general it is about the reinforcements of existing power stations and of reduced size.

This kind of groups is considered in the majority of the Western African countries and in particular Burkina Faso, in Togo/Benin, Niger and Senegal.

[1] It is the different seasonal movements of cyclic character, carried out by the stockbreeders with inside their usual pastures. At the beginning of the rain season, the shepherds move with their herds towards the northern salted pastures. They do not return towards the south before after the release of the fields

2.4.4. Biomass

The use of biomass in complement or replacement of coal in thermal units will have to be the subject of the same environmental studies as the units running exclusively on coal.

In addition, the impact on sustainable development will have to be taken into account in the choice of the source of biomass, essential component in the choice of the development of this field, which represents an unquestionable opportunity for the studied area.

Finally, wood dust being regarded as a flammable substance, this aspect will have to be taken into account in the safety studies.

2.4.5. Renewable energies (solar, wind)

The impact of the solar projects (in particular in Burkina Faso, Togo, Benin and in Mali) was not analyzed in terms of environment at this stage given the absence of accurate data on these projects. In a general way, the environmental and social impact expected is small for these projects.

For the installation of large wind farms, the impact should be studied according to the localization of these farms. The impact will be directly proportional to the neighboring population density (noise, stroboscopic effect, risk, visual effect,…).

It will be necessary also to take the birds' migration corridors and the great zones where certain large birds spend part of the year into account.

2.4.6. Hydroelectric power plants

In general, the social and environmental impact of the construction of an hydroelectric power plant is very important and often in direct relationship with the surface of the storage reservoir created

The environmental and social risks of the main hydroelectric projects are presented hereafter.

2.4.6.1. HYDROELECTRIC SITE OF SOUAPITI

2.4.6.1.1. Project description

The project would consist in building a dam with a plant of 750 MW upstream of the hydroelectric site of Kaleta (850 m upstream of Souaptiti Bridge) and downstream the hydroelectric site of Garafiri. The situation is presented in the next figures.

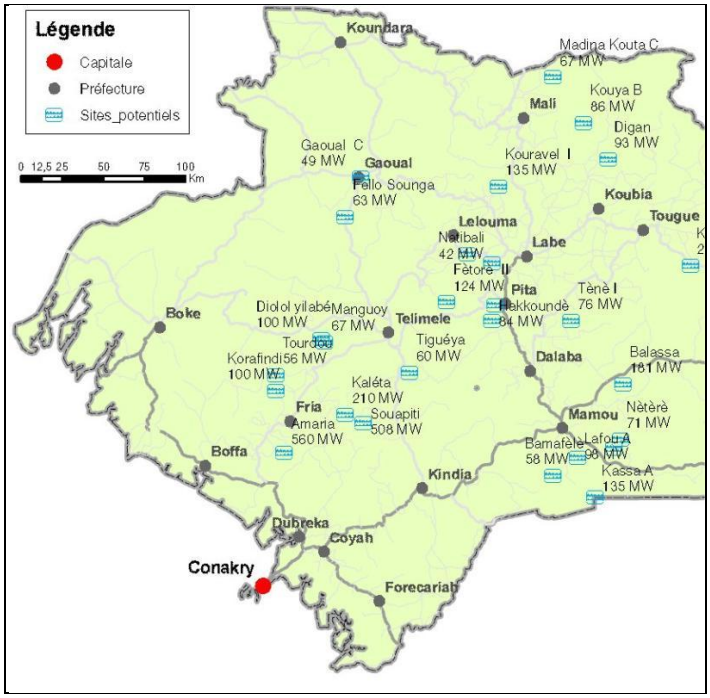


Figure 53: Location of Souapiti, Kaléta and Amaria dams

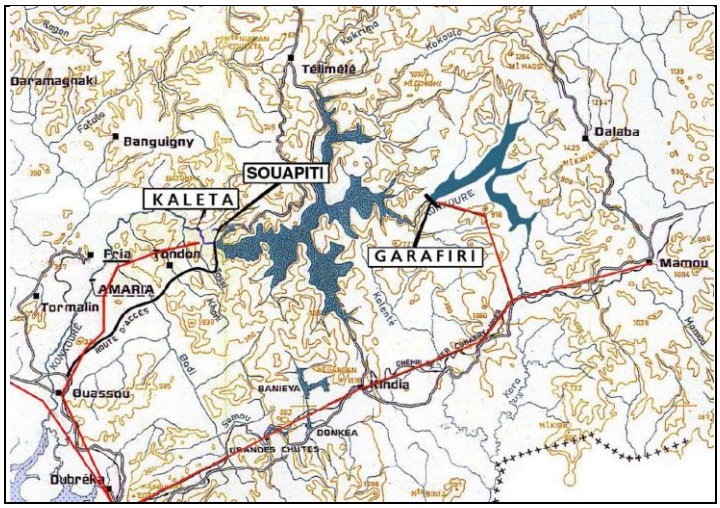


Figure 54: Presentation of the project according to Coyne et Bélier study

Figure 55: Dam location

At present, we have no accurate information on the project characteristics, except for those from the feasibility study of 1989.

The available information is presented in table hereafter.

- Hydrological characteristics

Catchment area	km²	10800
Average discharge of Konkoure	m³/s	328
Flood peak decamillenal flow	m³/s	4100

- Basins characteristics

Normal Basin (NB)	(SMK)	230
Basin area at NB	km²	**652**
Total capacity under NB	hm³	17 300

- Dams characteristics

Type		weight BCR
Crest total length	m	1150
Volume total	m³	4500000

- Flood sluice

Sluice type		threshold free
Maximum restored from (project flood)	m³/s	3000
Annex dyke	hm³	852000
Population displacement	Population concerned: **40 000 p.**	
Carrying time		5 years

The evacuation of the energy produced in Souapiti should be assured by 225 kV lines to reinforce the connections from Kaleta located 6 km further.

We know as well that a call for tender was released in May 2011 for carrying out an environmental impact study.

2.4.6.1.2. Project justification

The project is justified because it will allow ensuring a production for mining sites and will take advantage of infrastructures (lines, roads,…) that were already built for Kaleta. Also according to the existing studies, it will control and regularize the water discharge in Kaléta, allowing a yearly production at maximum capacity of this site whose capacity would pass from 150 MW - 788 GWh/year to 225 MW - 1356 GWh / year.

2.4.6.1.3. Initial situation of the environment

In the absence of impact study on the project, the description of the initial state has been carried out on the basis of a study carried out for the APD of the Kaleta project in 2007.

2.4.6.1.4. Catchment area characteristics

The "Konkouré River takes its source in Fouta-Djalon near Mamou at an altitude of approximately 950 m. Its course presents several rather abrupt changes but preserves a general orientation centered towards the west to its confluence with Kakrima. This one comes from the North-East and drains with its principal affluent, Kokoulo, an under-basin a little less sprinkled but appreciably wider than the one of higher Konkouré. After its confluence with the Kakrima, the Konkouré runs in south-western direction, receives the Mayonkouré from the left bank coming from the area of Kindia, then, with a few kilometers downstream from the bridge of the Kindia-Télimélé road, receives the Taouli from the left bank and inflects its course towards the West. It passes then on the level of Souapiti and crosses the falls of Kaléta after having received a last affluent from the right bank, Kaga. Beyond the site of Kaléta, Konkouré directs again its course towards the south-west and receives Badi on the left bank.

The catchment area on the level of the site of Kaléta is of 11.380 km ².

The average altitude of the catchment area is close to 600 m. Upstream of the falls of Kaléta, the level of the river in very low waters is of approximately 99 m.

The basin is bordered in North and in the North-East by the massif of Fouta-Djalon whose summits are higher 1.200 m. The main part of the basin however has a hilly relief of plateaus whose altitude lies between 200 and 1.000 m. The valley of Konkouré and those of its principal affluents often offer a profile transversely in steps, comprising a succession of sandy cliffs and terraces.

2.4.6.1.5. Geology

From a geological point of view the entire basin of Konkouré is presented in the form of a vast primary massif resting in discordance on a granito-gneissic Precambrian base.

All the formations are covered with an important coat of deterioration, relatively permeable and supporting the mitigation of the surface streaming. On the siliceous sandstones this coat generally consists of permeable sands often covered with a ferruginous carapace. The deterioration of the schists and dolerites leads to the formation of laterites and ferruginous or bauxitic armors. On some plateaus, very powerful lateritic formations ("bowés") can be found whose surface forms an armored, practically impermeable carapace with rainwater and locally supporting the streaming. The sandstones, strongly fractured, have a certain permeability into large which confers a considerable holding capacity to them. This retention capacity is added to one of their sands of decomposition to favor the support of the low water levels during the dry season.

2.4.6.1.6. Climate

The catchment area of Konkouré is subjected to a tropical climate of transition which is characterized by one dry season in the winter and a wet season in the summer with a high average temperature and a relatively strong annual pluviometry.

Characteristics of this climate can be explained by the mechanism of the circulation of two air masses:

- the harmattan which is a tropical continental, dry and very hot air in the summer, coming from the Sahara. Its general direction is North-East;
- the monsoon which is a maritime equatorial, wet, unstable and rather cold air. From South-Western general direction, it comes from the Sainte Hélène anticyclone.

There is a movement of rocker between the harmattan and the monsoon. The latter in its incursion towards the North penetrates under the harmattan. The trace on the ground of the surface of contact between these two masses of air is called the Intertropical Front (the ITF).

In April, the arrival of the ITF on the basin is marked by a rise in the relative humidity on the ground and the formation of dry tornadoes but with very little downpours.

Then, the thickness of the air corner of the monsoon rises gradually and the first tornadoes occur aligning themselves on a East-West line parallel to the ITF. When the thickness of the air corner reaches 2.000 m, series of tornadoes occur. These tornadoes are short, violent and cover a surface limited to a few hundred km². When the thickness of the monsoon is maximum, the unstable cloudy formations of this mass of air give place to continuous monsoon rains, less intense but able to last for several hours.

Finally, in September-October, the ITF goes down again towards the south with a reduction then absence of precipitations. From November until the beginning of April, practically no rains are observed.

The temperature of the air in Souapiti is high and varies little during the year and from one year to the other. The absolute maximum temperatures are highest between February and April (41 to 44°C in general) and the lowest in August and September (34 to 37°C).

The absolute minimal temperatures pass by a maximum in the middle of the rain season (19 to 22°C) and by a minimum in December and January (8 to 17°C). The diurnal temperature variation is very important when there is the Harmattan (25 to 30°C from January to March) and decreases very smoothly with the arrival of the monsoon (13 to 18°C in August-September). The monthly average temperatures are maximum from February to April (28°C) and minimal in August (25°C). »

2.4.6.1.7. Vegetation

On the major part of the basin, the vegetation is of "wooded Guinean savannah" type with forest galleries in the valley soil. In altitude, one passes from a less developed shrubby savannah, to the meadow of the high plateaus.

The zones of cultures are not very important and are often limited to the alluvial grounds where the villages are. It is primarily food crops (manioc, rice) and some plantations of palm oil trees, banana trees, pineapple and coconuts.

The relative importance of the vegetation cover is a favorable factor to the retention of water and to the reduction of the streaming and erosion.

Regarding the zone upstream of the project, it appears, considering the analysis of the available satellite photos, that the zone is heavily occupied (several villages and the large majority of spaces are occupied by cultures or fallow). Very little natural or forest zones remain (except for the forests gallery along the marshlands)

The gallery-forests follow the rivers and are generally limited to a curtain of trees along each bank. The density, the height and the width of the vegetation are variable and depend on the importance of the river. Certain galleries will have a width of 2-3 m and others 20 to 80 m, or even more. This formation is generally very productive and contains in average 350 t. of dry matters per hectare.

The gallery-forests are pluristratified:

- a lower stratum made of herbaceous plants and shrubs;
- an medium stratum whose covering is relatively important (60%) and often consists of palm oil trees (Elaeis guineensis);
- a higher stratum not recovering (average covering of 10%);

On the slopes between the river and the plateau (Bowé), we can observe the presence of Guinean savannah (or cultivations) on zones formerly occupied by the dense mesophilic forest. This type of vegetation should represent between 80 and 90% of the total surface that will be flooded if we consider that the plateaus will be spared. The shrubby layer represents approximately 30% whereas the arborescent layer represents an average covering of approximately 10%.

On the plateau especially grassy savannah can be found. This savannah is characterized by the absence or the scarcity of trees and shrubs. This type of vegetation is generally localized on the cuirasse plateaus (Bowé). The shrubby stratum can constitute up to 30% of the covering.

2.4.6.1.8. Population

The population density in the project area is presented at the next figure:

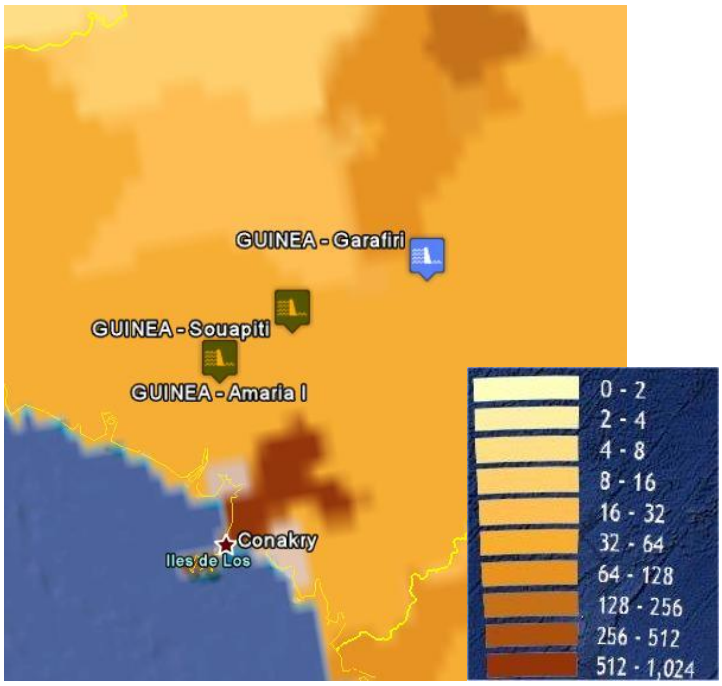


Figure 56: Population density in the project area

From this figure, it appears that the vast majority of the site is an area with a population density between 16 to 32 inhabitants per km². If the reservoir covers 625 km², the impacted population would be between 10000 and 20000 persons (first estimate was 40 000). It represents several villages, and is confirmed by observing satellite pictures.

2.4.6.1.9. Environmental Impact of the project

The symbols used are presented in the methodology and the explanations on the retained choices are given after the table.

Impact on:	Studies and preparation	Construction	Presence and utilization
Micro climate and air quality	X	N, mi, p, Di, T, Im	-, me, c, Di, L, Sh
Grounds and underground waters		N, mi, p, Di, T, Im	-, me, c, Di, L, Sh
Surface waters		N, Me, c, Di, P, Im	N, Ma, c, Di, P, Im
Vegetation	N, mi, c, Di, L, Im	N, Ma, c, Di, P, Im	N, Ma, c, Di, P, Im
Fauna			N, Ma, c, Di, P, Im
Population (moving)	x	N, Ma, c, Di, P, Im	
Socio-economy	N, mi, p, Di, T, Im	N, Ma, c, Di, P, Im	P, Me, c, Di, P, Im
Health and security	x	N, Me, c, Di, P, Im	N, Me, c, Di, P, Im

2.4.6.1.10. Micro climate and air quality

During the works, an impact on the air quality will be noticeable in the works area.

After realization, the large surface of the lake (more than 600 km²) will locally influence the micro-climate, especially during the dry season. The dam should play a buffer role in the temperature variations and ensure a high humidity rate.

2.4.6.1.11. Ground and ground water

Principal impacts are an important loss of space (ground losses) and the modification of the regime of the groundwater. This latter aspect can not be quantified for now.

2.4.6.1.11.1. Surface waters

During the works, a modification of the turbidity of the river will be first noticed due to the derivation of the river. With the presence of the dam, the impacts will be major since the discharge will be modified and the water quality will also change. At the beginning, the vegetal decomposition will increase the eutrophication and later on, the stagnation of the water could results in its quality modification. This modification can have impacts downstream on the vegetation and on the whole biodiversity up to the estuary as explained later.

2.4.6.1.12. Vegetation

As for all large dam, the impact on the vegetation will be multiple and major. At first, numerous hectares of natural zones will be flooded and destroyed. It will mainly be gallery-forests and Guinean savannah (or cultivations). Very few mesophile forests remain in the area, but the on-going impact study will have to precise it.

Then, the water regime modification in the area and downstream, and the evolution of human population will cause gradually but unavoidably a deep change in the vegetation of the project area. We will see an intensification of the cultivation, a rise in wood needs, and son on.

Downstream, with the modification in regime (more regular) and water quality, we will see a modification of gallery-forests, and probably, as expected by first studies, a modification of the dynamics of mangroves in the estuary. Mangroves are indeed very sensitive to alternances in fresh and sea water and their production also depends on the nutrients brought by the rivers.

2.4.6.1.13. Fauna

The construction and the flooding will destroy a large number of terrestrial species and above all their biotopes. The impact will then be major. Then the change in the river discharge (becoming a lake), will cause deep changes in terms of aquatic ecology. Numerous species will have to migrate upstream (those living only in running water). A separation will install itself between the species downstream and upstream (no possibilities of ascent).

As for the vegetation, the species downstream will have to adapt to know a less variable discharge with less productive waters (after vegetal decomposition). This modification will probably be noticeable up to the estuary.

For terrestrial fauna, the evolution of human population after the population displacement and the arrival of new inhabitants attracted by jobs and activity opportunities will increase the pressure. A last element to take into account is the cut-off effects of the lake that can (to be verified) bring an isolation of some animal population.

2.4.6.1.14. Socio-economic impacts

- **Population impact**

Base on the information (fragment) and on a first evaluation, the impact on population will be major and highly negative because between 10 000 and 40 000 persons will have to be moved. This number is huge and will provoke a lot of difficulties in terms of movements (new persons arriving to benefit from indemnities, lack of space in the area, fraud,…)

After the construction, the superficy of the lake will also cause a lot of communication problems between villages and for the inhabitants located north of the project who have to go to Conakry. The main road (N24) will be flooded and a new road will have to be built (via Souapiti or Fria).

- **Economic impact**

Moving the population will lead to high economic losses for this population (production goods, trees, lands, shacks, houses, granaries…). An estimate of 11 000 to 13 000 ha of cultivable land will be lost[2].

It will be impossible to give indemnities for the totality of these goods.

Then, the lake presence will have various effects, positive as negative. The benefits effects are of course the opportunity of developing new activities (fishing, pisciculture, irrigated cultures,…). Similarly, the electrical production will have an unquestionable benefit, but not for the same population.

About negative sides, in addition to the loss of the production units, the isolation of the zone of Télimélé can have a certain effect on the region economic activity. Similarly, if the modification of the water regime has consequences on the estuary.

2.4.6.1.15. Health and security impact

Accidents during the works are more than likely, and the impact of the construction is to be considered as negative. A good prevention will be necessary as for workers than for the population.

The presence of the lake can bring modifications in the prevalence of diseases related to water (malaria, onchocerose,…), which represents also a negative impact in terms of health. Another aspect is the cut-off effect that will bring for a certain population a difficult and laborious to health care, because of the distance.

Other impacts are also possible but so far, we don't have the ambition of covering all the aspects.

[2] Source: Karim Samoura – Contributions méthodologiques à l'évaluation environnementale stratégique de l'exploitation du potentiel hydroélectrique des bassins côtier en milieu tropical: cas du Konkouré, en Guinée – Université du Québec in Montréal – January 2011

2.4.6.1.16. Conclusion

The impact of the project (even with large attenuation measures) will be very important and negative, essentially because of the detention lake. Indeed, the construction of the installation should cause the displacement of 10 000 to 40 000 persons. If the surface of the lake is reduced and if the investment is increased by 15% to guarantee that a plan for displacing and re-settling the people is applied, combined with an environmental action plan, the actualization of the project studies and the implementation of the project can be envisaged.

2.4.6.2. HYDROELECTRIC SITE OF AMARIA

2.4.6.2.1. Project description

The site of Amaria is in Maritime Guinea, downstream the confluence of Kondouré and Badi Rivers, a few kilometers downstream the dam of Kaleta and 10 km south of the mining town of Fria. The dam will be made of ground with a normal detention height of 93 m and an installed power of 665 MW.

Figure 57: Locations of Souapiti, Kaléta and Amaria dams

For this site, we could not find any estimate of the floodable superficy, which should nevertheless be less important than for Souapiti. A recent study estimates however the loss of cultivation area to approximately 10% of the one for Souapiti[3].

As for Souapiti, the project is justified because it will permit to ensure a production for mining sites and will take advantage of the infrastructure (line) already built for other projects in the region.

2.4.6.2.2. Initial situation of the environment

Without detailed study about the project, we can consider the description made for the project of Souapiti is a valid base, confirmed by the study of pedologic maps of the area[4].

[3] Source: Karim Samoura – Contributions méthodologiques à l'évaluation environnementales stratégique de l'exploitation du potentiel hydroélectrique des bassins côtiers en milieu tropical: cas du Konkouré en Guinée – université du Québec in Montréal – January 2011

2.4.6.2.3. Population

We remain in a zone of average population density of 16 to 32 persons per km². The population density is estimated to 29 inhabitants/km² for Maritime Guinea. If the reservoir is 10% of the one of Souapiti, the impacted population would be approximately 1000 to 2000 persons.

2.4.6.2.4. Environmental Impact of the project

The Amaria project is little documented with environmental and feasibility studies. Given the little information available, we can not reasonably build a matrix of environmental impact.

The exploitation of the site, not far from the estuary of Kondouré River, would present some important threats for the environment, the infrastructures and the human implantation in coastal area. This is the reason why its realization is seldom envisaged by the Guinean authorities.

The impact of the project should be considerably less important than the dam of Souapiti, except for the impact on mangroves.

Only detailed satellite pictures or a mission on the ground will permit to be more accurate on the potential impacts.

2.4.6.2.5. Conclusion

The project would have an important impact on the environment, particularly on the mangrove. However, little information is available to conclude with a full diagnosis of the regional impacts.

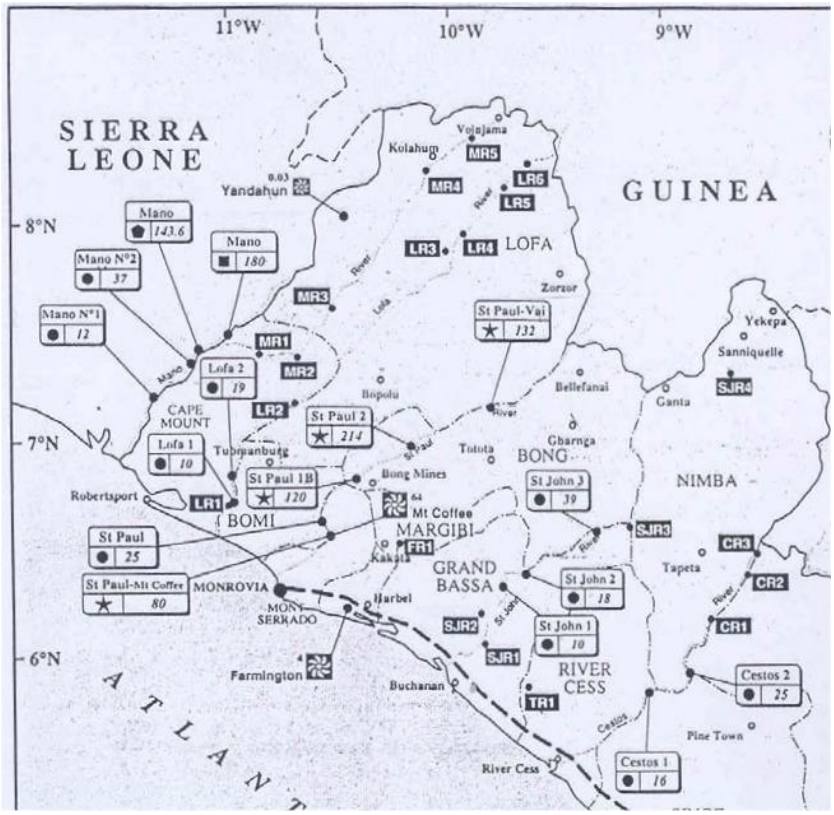
2.4.6.3. HYDROELECTRIC SITE OF SAINT-PAUL

The St-Paul River has approximately 52% of the hydroelectric potential of Liberia. On that river, many installations were programmed. In August 2007, a study mentioned that the hydroelectric project is the valorization of the St Paul River which is a potential local resource should contribute in supplying Liberia's needs in the long term.

The different potential sites are illustrated on the next figure[5].

[4] Pedestrian recognition ma pat 1/5000.000 of Guinea

[5] The reporting project of emergency supply plan to absorb the energy deficit faced by the ECOWAS countries



Potential sites for hydro projects in Liberia.

In 2008, a study was carried out[6] and recommended to implement the project of Mount Coffee, concluding that « *The Optimum Project is deemed to include a four-unit, nominal 66 MW installation at the existing Mt. Coffee facility. In addition and in order to supplement dry season discharge serving Mt. Coffee, the Optimum Project also includes a new two-million acre-foot storage reservoir constructed near the confluence of the St. Paul and Via Rivers. The estimated annual energy generation of the Optimum Project is 435 GWh.* »

This reservoir lake located far upstream the plant will have to supply the plant during the dry season. Nevertheless, this reservoir will have an important impact on the environment because it is located, for its largest part, in the "Lorma" protected forest. It will cover 208 km² and provoke the displacement of approximately 6 villages and 12000 persons (2007 estimate). To this must be added the indirect impact (decrase in resources for population living along the lake), the disappearance of ford passage in the dry season downstream the dam and consequently the social relation losses between the two sides.

Other important effects are presented in the matrix hereafter.

[6] Technical and Financial Feasibility Study for the Reconstruction and Expansion of the Mount Coffee Hydropower Facility in Liberia – 2008 (Stanley Consultant)

Impact on:	Studies and preparation	Construction	Presence and utilization
Micro climate and air quality	X	N, mi, p, Di, T, Im	-, me, c, Di, L, Sh
Grounds and underground waters		N, mi, p, Di, T, Im	-, me, c, Di, L, Sh
Surface waters		N, Me, c, Di, T, Im	N, Ma, c, In, P, Im
Vegetation	N, mi, c, Di, L, Im	N, Ma, c, Di, P, Im	N, Ma, c, Ini, P, Im
Fauna	N, mi, c, Di, L, Im	N, Ma, c, Di, P, Im	N, Ma, c, Ini, P, Im
Population (moving)	x	N, Ma, c, Di, P, Im	N, Ma, c, Di, P, Im
Socio-economy	N, mi, p, Di, T, Im	-, Me, c, Di + In, T, Im	P, Me, c, Di, P, Me
Health and security	x	N, Me, c, Di, T, Im	N, Me, c, Di, P, Sh

The project seems to be already decided and considered as priority in the frame of the CLSG system development. The environmental impact will however be very important and the project will be difficult to implement.

2.4.6.3.1. Other projects on the St Paul River

The former studies had also identified the projects of St Paul 4 and V.1 consisting, in addition of the dam construction on the river Via, in building a small detention on the St Paul River and a communication channel between the lake and this dam. This project will cause even more important environmental effects (probably not on the population) but it should allow the energy production from the Via detention lake.

A second project identified is the project downstream the Via dam, named St Paul 2. This dam should permit an important production, but we have no indication on the nature of the installation or the scale of its impacts. If all impact mentioned for downstream are of the same kind, the upstream impacts will probably be less important but only the lake surface analysis would permit to evaluate accurately these aspects. Similarly, it is unclear whether the announced productions include the Via reservoir construction.

A third project, named SP-1B will be downstream St Paul 2, close to the village of Fauta. For this project, we also lack information to evaluate its environmental impact. We can observe that it is in zone with higher population density, with a risk of impacting more persons (see figure hereafter, but there are less protected areas.

Figure 58: Population density in Liberia

2.4.6.3.2. Conclusion

We can say that, though the St Paul River and its Via affluent present an unquestionable potential, the valorization will have an important impact on the environment.

The project with the highest impact will be the detention lake (St Paul Via) but it will increase the production of the other projects (St Paul 1 B, 2, …). It is therefore important to note that these projects will also have an impact on the environment.

Given the fact that the projects are located in the same hydrographic basin, and then linked, with important environmental consequences, a global study is recommended to define a global hydroelectric plan for the river and its affluent in order to minimize the negative impacts.

2.4.6.4. HYDROELECTRIC SITE OF MANO RIVER

Tow projects are expected on the Mano River between Sierra Leone and Liberia. The figure hereafter indicates also the protected areas.

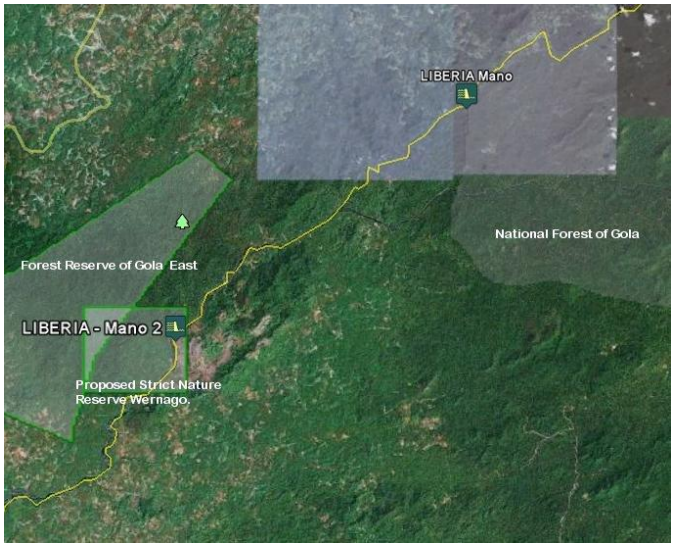


Figure 59: Mano projects sites and location of protected areas

For both sites, the reservoir will affect partially protected areas, either in Sierra Leone, or in Liberia.

Today, it comes out that the site of Mano 2 would be more appropriate and also close from the town of Kongo (small mining town) but only a detailed study of the present situation and of the location of the « Wernago » area proposed for protection status would allow being more accurate on the choice.

A railway also arrived in Kongo and in Sierra Leone and the re-development of mining activities is interesting.

2.4.6.4.1. Conclusion

There are two sites for which the reservoir will impact protected areas either in Sierra Leone or in Liberia. Today it appears that the site of Mano would be more appropriate.

2.4.6.5. HYDROELECTRIC SITE OF BUMBUNA

2.4.6.5.1. Project description

The hydroelectric project of Bumbuna, located in Kalansogoia region on the Seli River, presents different phases with a maximum production potential of 275 MW.

The first phase is a dam 2.4 km above the falls of Bumbuna. Started in 1986, the project stopped because of the civil war in 1977. The project, commissioned in 2010, consists in a dam with a height of 88m and two power plants of 25 MW each. The lake extends on 21 km². Bumbuna 1 varies from 50 MW during the rainy season to 18 MW in the dry season. Nevertheless, it is assumed here that the annual management of the reservoir allows facing the peak load so that the available capacity (at peak) matches the installed capacity of 50 MW.

The second phase, expected for 2017, consists in extending the existing site (from 50 to 400 MW) and building a dam in Yiben upstream. According to previous studies, this dam will form a lake of 122 km² (estimate from EIS based on the feasibility study carried out in 1980) and 190 km² (recalculation of the surface determined in 1980). The lake is presented further in this chapter.

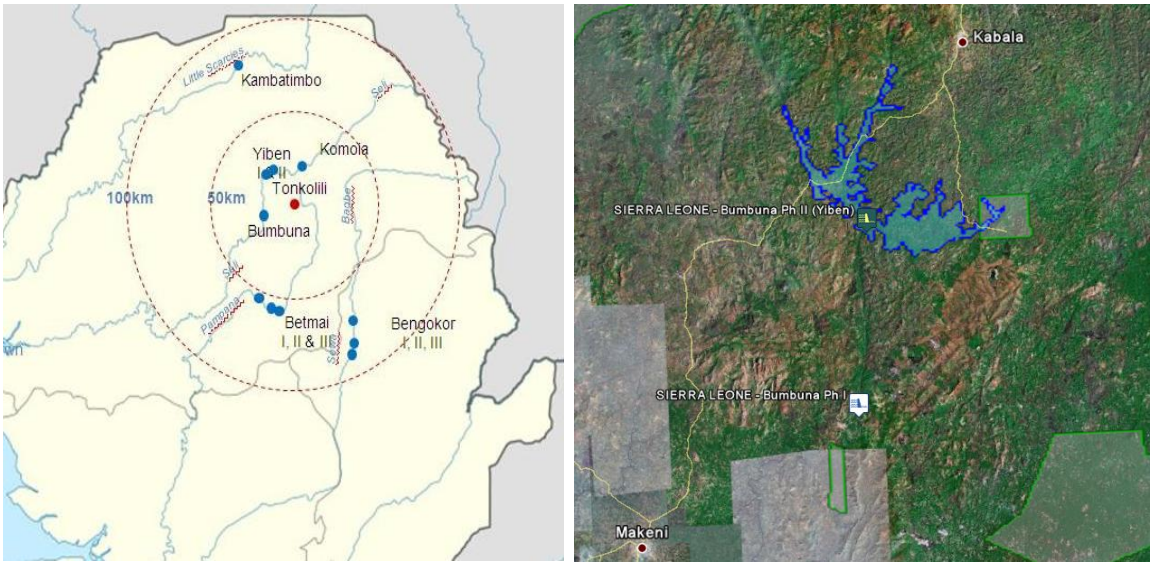


Figure 59: Locations of Bumbuna and Bumbuna (Yiben) dams

Figure 60: Existing dam of Bumbuna, platform and entrance tower

At this stage, we have no accurate information on the second dam (Bumbuna Yiben) and we took into account the project of 1980 with a detention of approximately 190 km².

The evacuation of the energy produced in Bumbuna should be ensured by a 161 kV line towards Freetown.

2.4.6.5.2. Initial situation of environment

Given the little information we have on the project of Bumbuna (Yiben), the following points are mainly based on the environmental impact study done for Bumbuna phase 1 project, realized by Nippon Koei UK in 2005. Indeed, the new project is located 28 km upstream the existing one and we assume the environmental context is not so different. However, about some points, a more detailed study will have to be carried out on the site of the new project.

2.4.6.5.3. Physical conditions

The important elements are the rain and the discharge of the river. Indeed, the capture is distinct between the rainy season (from May to October) and the dry season. The yearly average pluviometry is 2635 mm, with a maximum of 594 mm in August and a minimum of 0. The maximum average discharge of the Seli River in Bumbuna is 331m³/s in September and a minimum of 6.1 m³/s in March. The highest peak discharges are between July and October (600 and 1200 m³/s). The yearly average is 113 m³/s, corresponding to 890 mm of rain per year.

The ground in the region reflects the leaching due to abundant rain. They are highly acid and of low fertility, with most of the nutrients in superficial layers where humus (vegetation in decomposition) is present.

2.4.6.5.4. Water quality

The Seli River is a typical river of West Africa, highly influenced by the seasonal variations of the rain. The main characteristics of the water are:

- Low dissolved salt concentration;
- Low nutrient concentration;
- High dissolved oxygen concentration and low DBO and DCO value ;
- Low pollution;
- No major variation in the water quality from upstream to downstream or along a day.

2.4.6.5.5. Vegetation

The vegetation can usually be described as a mosaic of forests and savannah. In 2004, a census showed 155 species among which some were registered as endangered (*Tieghemella heckelii*) or vulnerable (*Entandrophragma utile, Lovoa trichilioides, Nauclea diderrichii* et *Terminalia ivorensis*).

There is a protected area that could be impacted by the project (Sofon Lake National Park)

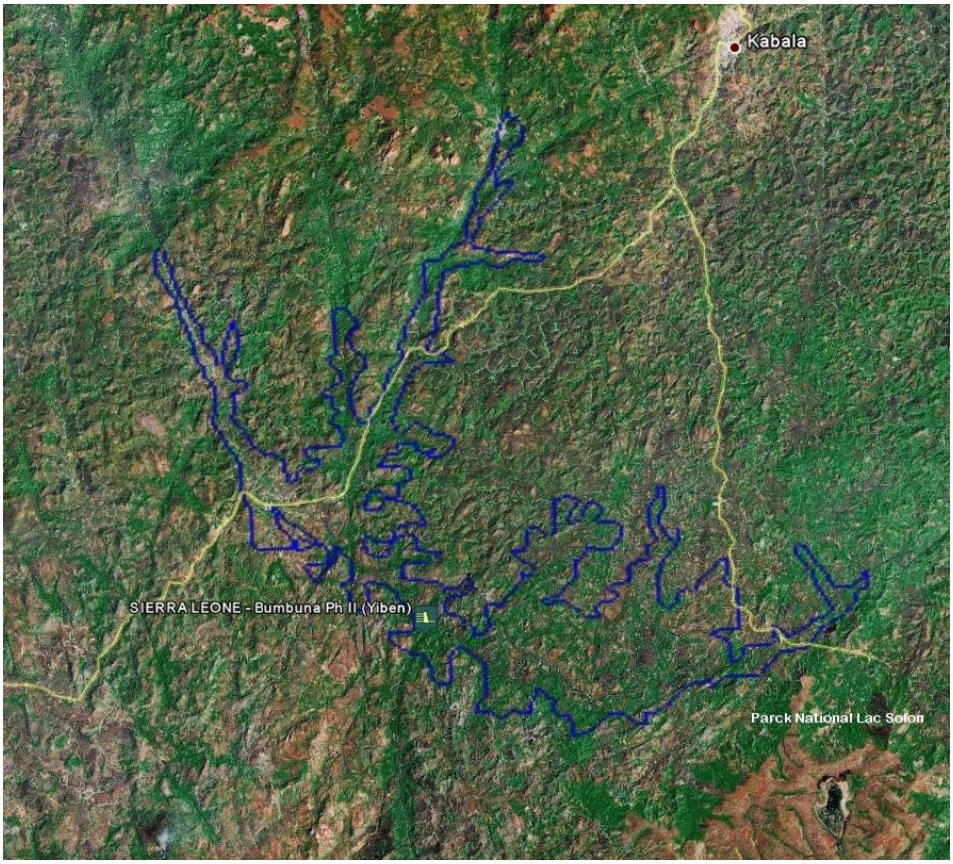


Figure 61: Detention n lake area

2.4.6.5.6. Fauna

En 2004, 13 mammals species were counted, among which the chimpanzee (endangered specie), *Cephalophus silvicultor* (vulnerable specie), 3 rodent species: *Praomys jacksoni-malacomys* and *Praomys tullbergi.*

A specific study on chimpanzee detailed that there are several communities. The habitat of the specie is not considered as critical by the World Bank. Other primate species were observed like the Cercopithecidae.

Hundred twenty-eight birds species were registered, among which 12 are rare but not endangered.

Twelve amphibian species and six reptile species were registered in 2004 but it is certain there are none anymore.

Thirty-six fish species of the most important families of the African rivers are present. There is then no rare or endemic species.

2.4.6.5.7. Population

The population density in the project area is presented in the next figure.

Figure 62: Population density in the project area

From this figure, it appears the the site of Bumbuna is in a zone where the population density is between 32 and 64 inhab/km². Bumbuna (Yiben) is in a less populated zone where the population density is between 16 and 32 inhab/km².

The picture resolution being quite bad, we cannot distinguish the villages in the vicinity of Bumbuna (Yiben).

The region is relatively isolated and under-developed, except for the village of Bumbuna but it is not concerned by the project.

The most important ethnic group is the Limba with small proportions of Mende, Fula and Temme. They have their own traditions but they have similarities as the secret traditional societies, the Krio language use and their religions (traditional, catholic and Islamic)

2.4.6.5.8. Project impact on the environment

The symbols used are presented in the methodology and the explanations on the retained choices are given after the table.

Impact on:	Studies and preparation	Construction	Presence and utilization
Micro climate and air quality	X	N, mi, p, Di, T, Im	-, me, c, Di, L, Sh
Grounds and underground waters		N, mi, p, Di, T, Im	-, me, c, Di, L, Sh
Surface waters		N, me, c, Di, P, Im	N, me, c, Di, P, Im
Vegetation	N, mi, c, Di, L, Im	N, Ma, c, Di, P, Im	N, Ma, c, Di, P, Im
Fauna		N, Ma, c, Di, P, Im	N, Ma, c, Ini, P, Im
Population (moving)	x	N, Ma, c, Di, P, Im	N, me, c, Di, P, Im
Socio-economy	N, mi, p, Di, T, Im	P, me, c, In, P, Im	P, me, c, In, P, Im
Health and security	x	N, me, c, Di, P, Im	N, me, c, In, P, Im

2.4.6.5.9. Micro climate and air quality

During the works, an impact on the air quality will be noticeable in the works area.

After realization, the water of Bumbuna (Yiben) will influence locally the micro climate, mainly during the dry season. The detention should have a buffer role in the temperature variations and ensure a high humidity rate.

2.4.6.5.10. Ground and ground water

The main impacts are an important loss of space (ground losses estimation of 190 km²), and the modification of the groundwater regime. The latter aspect can not be quantified at this stage.

2.4.6.5.11. Surface waters

During the works, there will be a modification of the turbidity with the derivation of the river. With the presence of the detention, the impacts will be major because the discharge will be changed as well as the water quality. At the beginning, the vegetal decomposition will strongly increase the eutrophication and later, the water stagnation could provoke modification in the water quality (with an impact on activities like fishing). This modification can have downstream impacts on the vegetation and on the whole biodiversity. This modification will be moderate since the existing dam already caused changes. The modification of the discharge in period of low water level can also have an important impact.

2.4.6.5.12. Vegetation

As for all large dam, the impact on the vegetation will be multiple and major. At first, numerous hectares (more than 100 km) of natural zones will be flooded and destroyed. It will mainly be forests, savannah or cultivations. The impact study will have to precise at best the ground occupation impacted by the project.

Then, the water regime modification in the area and downstream, and the evolution of human population will cause gradually but unavoidably a deep change in the vegetation of the project area. We will see an intensification of the cultivation, a rise in wood needs, and son on.

Downstream, the impact will be felt far after the lower Bumbuna dam (28 km).

2.4.6.5.13. Fauna

The construction, and especially the flooding, will destroy a large number of terrestrial species and their biotopes. The impact will then be major. Then, the change in the river regime becoming a lake will cause a change in terms of aquatic ecology. A lot of species will have to migrate upstream (mainly those living only in running water). A separation will install between the upstream and the downstream species (no possibilities of ascent – already existing impact with Bumbuna dam, but it will be reinforced).

As for the vegetation, the aquatic species downstream will have to adapt to a less changing regime and less productive water (after the vegetal decomposition period). This modification will probably be noticeable far downstream.

For chimpanzees, the effect of the loss of habitat will be extremely negative, forcing groups to migrate. Particular attention should be given to this issue to avoid destroying this fauna by hunters and/or workers during the construction phase. It is possible there is an important development of bush meat trade during this phase.

For terrestrial fauna, the evolution of human population following the displacement of population, the arrival of new inhabitants attracted by the job or activities opportunities will highly increase the pressure.

During the environmental impact study, it will be necessary to also analyze if there is an impact on the Sonfon lake national park.

2.4.6.5.14. Socio-economic impacts

- **Impact on population**

The region does not seem highly populated but there is a risk of villages displacement. Based on the information (fragments) and a first evaluation, the impact on population could be important.

After the construction, the lake superficy will also cause many communication problems between villages and for the inhabitants. Important communication axes for the region will be cut and there is a risk of isolation of the population living in the middle of the one due to the lake with its shape of moon croissant.

Moreover, these populations have a great religious and cultural consideration to some sites. Their destruction will introduce important psychological damages.

- **Economic impact**

During the construction phase, it will be possible to hire local workers and the local economic exchanges will be reinforced but only temporarily.

The dam impact could permit to develop new activities (fishing, pisciculture, irrigation,…) Similarly, the electrical production will have an unquestionable benefit, but not for the local population. This problem had already been underlined in previous studies.

An other aspect to take into account is the possibility of better valorizing the Bumbuna falls which is a tourist attraction in the area. Similarly, the road between Kabala and Makeni will have to be put back into service to avoid isolating te northern areas.

2.4.6.5.15. Health and security impact

Accidents during the works are more than likely, and the impact of the construction is to be considered as negative. A good prevention will be necessary as for workers than for the population.

The presence of the lake can bring modifications in the prevalence of diseases related to water (malaria, onchocerose,…), which represents also a negative impact in terms of health.

2.4.6.5.16. Conclusion

The project will have a major impact on the fauna, the flora and their habitat and partly on the population. However, because it is an extension of an existing project, the introduction of new impacts on the water or downstream will be limited.

2.4.6.6. HYDROELECTRIC SITE OF KÉTOU (BENIN)

2.4.6.6.1. Project description

The project of Kétou-Dogo is foreseen with a hydroelectric plant of 160 MW on the Ouémé River with a yearly producible of 490 GWh.

The site is located at the level of the Dogo forest (see figure here after) close to the village of Bernandingon at approximately 150 km of Cotonou. It is accessible from Paouignan.

A feasibility study was carried out in 1992.

The main characteristics we have are:

- Catchment area superficy: 35 991 km2
- Yearly average inflows: 4 923 hm3

Figure 63: Location in the country

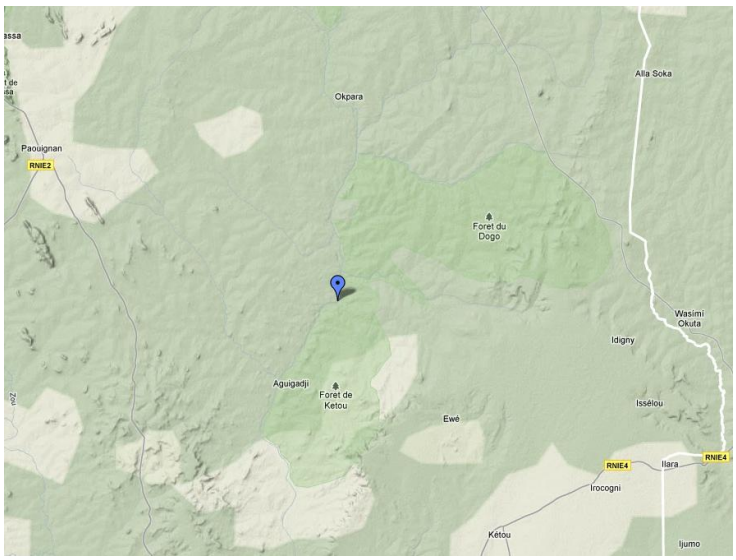


Figure 64: Expected location of the dam

The studies for the optimal laying out of the Ouémé River were achieved in 1992 with the following conclusions.

The laying out in Kétou Dogo presents the most interesting characteristics, particularly for the kWh price which lowers when the equipment power increases.

The study also says that the installation will have a strong pressure on the environment because the superficy of the flooded lands reaches 312 km² at normal detention. Moreover, observing the map shows that it is indeed a zone with little relief. A second impact will be the partial disappearance of the Dogo protected forest. This area of 31.850 ha was elected for protection by the act n° 2026 SE of 2 April 1955.

According to a study[7] about this forest, the vegetation is composed of a mosaic of forest formations from forest-galleries to tree and bush savannahs. The author also mentions that the ground is made of low height (between 100 and 200 m) plateau characterized at certain places by more or less rugged depressions.

In this study, it appears that the forest is strongly degraded and exploited for agriculture and charcoal production.

2.4.6.6.2. Project impact on the environment

The symbols used are presented in the methodology and the explanations on the retained choices are given after the table.

Impact on:	Studies and preparation	Construction	Presence and utilization
Micro climate and air quality	X	N, mi, p, Di, T, Im	-, me, c, Di, L, Sh
Grounds and underground waters		N, mi, p, Di, T, Im	-, me, c, Di, L, Sh
Surface waters		N, Me, c, Di, P, Im	N, Ma, c, Di, P, Im
Vegetation	N, mi, c, Di, L, Im	N, Me, c, Di, P, Im	N, Ma, c, Di, P, Im
Fauna			N, Ma, c, Di, P, Im
Population (moving)	x	N, Ma, c, Di, P, Im	
Socio-economy	N, mi, p, Di, T, Im	N, Me, c, Di, P, Im	P, Me, c, In, P, Im
Health and security	x	N, Me, c, Di, P, Im	N, Me, c, In, P, Im

2.4.6.6.3. Micro climate and air quality

During the works, an impact on the air quality will be noticeable in the works area. After realization, the large superficy of the lake (more than 312 km²) will influence locally the micro climate, mainly during the dry season. The detention should have a buffer role in the temperature variations and ensure a high humidity rate.

2.4.6.6.4. Ground and ground water

The main impacts will be a large loss of space and a possible modification of the regime of the groundwater.

2.4.6.6.5. Surface waters

During construction, a modification of the quality (turbidity) is to be threatened with a downstream impact.

7 Utilisation de la télédétection et des SIG dans la gestion durable des aires protégées: cas des forets classées de Dogo-Ketou au Benin par Folohouncho Bibiane ENONZAN - (DESS) 2010

After construction, with the presence of the dam, the impact will be important because the quality will evolve and the average discharge also. According to the literature, the Ouémé is a watercourse moderately abundant but irregular. It experiences from December to May an important low season with a severe decrease of its discharge. The average monthly discharge observed in February (minimum low water) reaches only 2.7 m^3/s, i.e. 220 times less than the average discharge of September and October, which testifies it high seasonal irregularity.

Over the 45 years observation period, its minimum monthly discharge was 0 m^3/s (dried up), while it maximum monthly discharge reached 1175 m^3/s.

The modification of the average discharge and the quality (eutrophisation) can have impacts downstream on the vegetation and the whole biodiversity, even as far as the Nokoué Lake and Porto Novo lagoon, both river estuaries.

2.4.6.6.6. Vegetation

As for all large dam, the impact on the vegetation will be multiple. At first, numerous hectares of natural zones will be flooded and destroyed, among which Dogo protected forest. It will mainly be gallery-forests, tree or bush savannah and cultivations.

Then, the evolution of the population dynamics (villages displacement, arrival of new inhabitants…) will gradually but unavoidably cause deep changes in the vegetation in the project area. We will see an intensification of the cultivation, a rise in wood needs, firewoods and charcoal.

Downstream, with the water regime (more regular) and quality modification, we will see a modification of gallery-forests, and probably a modification of the estuaries dynamics. Especially Nokoué Lake, and more particularly the area of Ganvié. This zone is classified as a Ramsar site.

2.4.6.6.7. Fauna

The flooding will destroy a large number of terrestrial biotopes (31200 ha). The impact will then be major. Then, the change in the river regime becoming a lake will cause a change in terms of aquatic ecology. A lot of species will have to migrate upstream (mainly those living only in running water). A separation will install between the upstream and the downstream species (no possibilities of ascent – already existing impact with Bumbuna dam).

As for the vegetation, the aquatic species downstream will have to adapt to know a less pronounced low water level and a quality variation. This modification will probably be noticeable until the estuary, but also upstream, because the area is actually populated by rather rheophile species (that like rapids more than stagnant water).

For terrestrial fauna, the evolution of human population will highly increase the pressure.

2.4.6.6.8. Socio-economic impacts

At this stage and based on the available information, it is very difficult to estimate the socio-economic impact.

Based on a population density between 16 and 32 inhab/km² and on a superficy estimate of 312 km², the impacted population will gather 5000 to 10 000 persons, i.e. 5 to 10% of the community of Kétou. This number seems possible because the county of Kétou has a population density of 28 p/km².

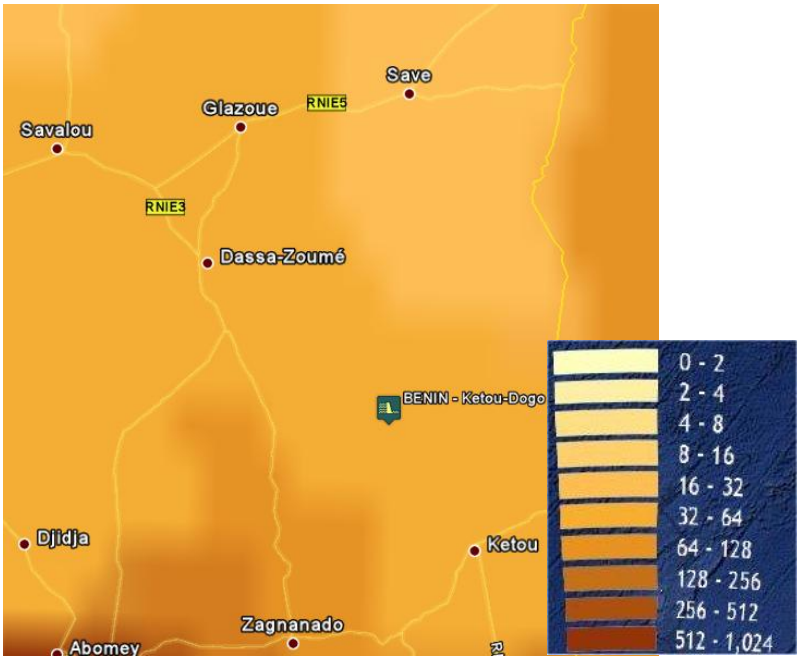


Figure 65: Population density in the project area

2.4.6.6.9. Impact on population

Based on fragments of information, the impact on population will be major and strongly negative. It is likely that it will also cause many difficulties in terms of displacement plans because it seems that several ethnies are concerned.

After the construction, the lake superficy will also cause some communication problems between villages. Hopefully no important communication way should be flooded.

2.4.6.6.10. Economic impact

The population displacement will cause as for the other projects important economic losses (trees, fields, shacks, houses, granaries, production goods,…)

It will be impossible to give indemnities for the whole of the goods.

Then, the lake presence will have various effects, positive as negative. The benefits effects are of course the opportunity of developing new activities (fishing, pisciculture, irrigated cultures,…). Similarly, the electrical production will have an unquestionable benefit, but not for the same population.

2.4.6.6.11. Health and security impact

As for the other projects, accidents during the works are more than likely, and the impact of the construction is to be considered as negative.

The presence of the lake can bring modifications in the prevalence of diseases related to water (malaria, onchocerose,…), which represents also a negative impact in terms of health.

2.4.6.6.12. Conclusion

The project impact (even with important mitigation measures) will be important and negative, in particular because of the detention lake. It is therefore essential to examine the problem carefully, to carry out a detailed social and environmental impact study and to integrate from today on a 15% construction costs increase to include the indemnities.

2.4.6.7. HYDROELECTRIC SITE OF ZUNGERU

2.4.6.7.1. Project description

The project will consist in building a dam on the Kaduna River, with 700 MW power plant. The site proposed in 1972 is presented in the next figure.

Figure 66: Expected location of the dam

2.4.6.7.2. Initial situation of the environment

The project is located in the state of Niger (Nigeria) 21 km upstream the town of Zungeru.

The new dam will come 83 km downstream Shiroro Lake, where there is already an electrical production and a detention lake with great superficy (312 km²). From the information about the dam, it appears that there is an important level difference between the rainy and dry seasons. This will then also happen in Zungeru Lake.

About population displacements, it seems the zone has a very high population density. Similarly, the observation of satellite pictures shows that many villages exist along the river. However, if the new lake had an important superficy, the impacted population would be significant.

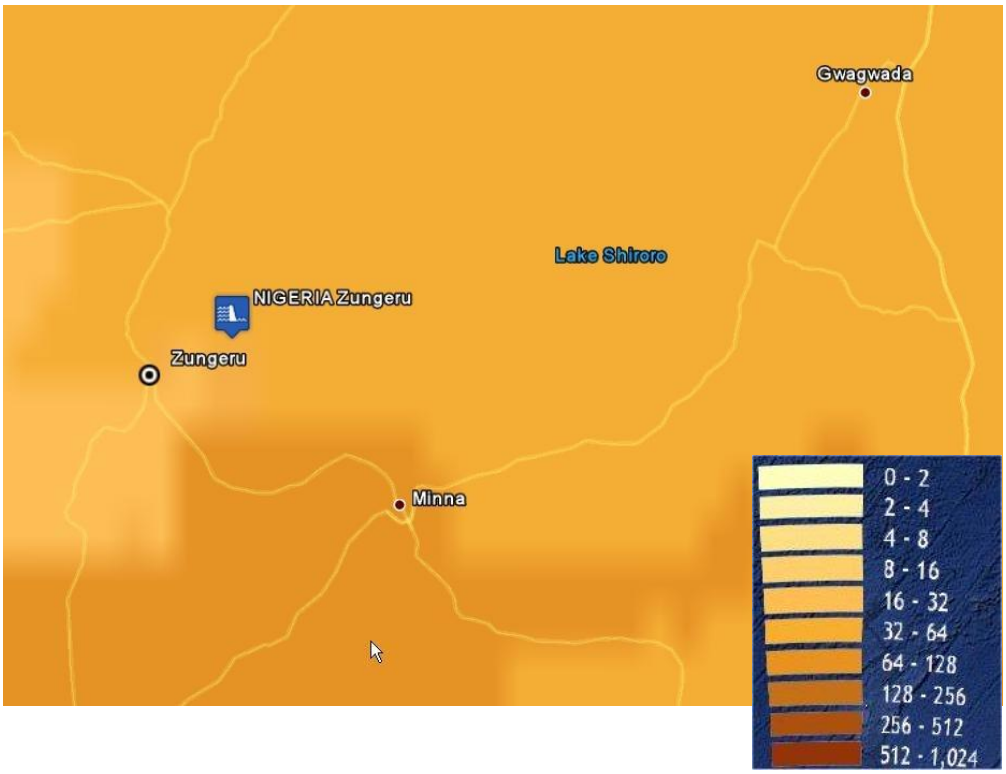


Figure 67: Population density in the project area

2.4.6.7.3. Project impact on the environment

The lack of information (notably on the detention surface, the location, the population) does not allow building a matrix of environmental impacts of the project at this stage.

The construction of the dam should have a too important impact on the water network of the Kaduna River which is already regulated by Shiroro dam.

2.4.6.8. HYDROELECTRIC SITE OF SOUBRÉ

2.4.6.8.1. Project description

The Sassandra River, 800 km long, takes its source in Guinea. The catchment area of Sassandra upstream of the Soubré site is of 62.000 km ² of which a part is controlled by the Buyo dam, located 60 km upstream. The average discharge is of 464 m3/s, that is to say an average annual contribution of 14 billion m ³.

The power of the Soubré dam project is of 270 MW (3 turbines of 90 MW each) with an expected annual producible of 1116 GWh.

Figure 608: Geographical localization of the project

Technical characteristics of the dam

Retention water level	RL 152
Installed power (MW)	270
Average energy (GWh/an)	1,116
Amount of people to dislodge	2,955
Retention lake surface (km²)	From 17.3 to 22.2 (*)

(*) During highest water levels (HWL) 154.5 m, this surface passes to 22.2 km. The zone of influence represented below is with dimension 152.

The technical data come from "the actualization of the feasibility study of the hydroelectric dam of Soubré - Synthesis of the report carried out by the Company SOPIE, June 2004".

2.4.6.8.2. Initial status of the environment

The project is situated in the department of Bas-Sassandra.

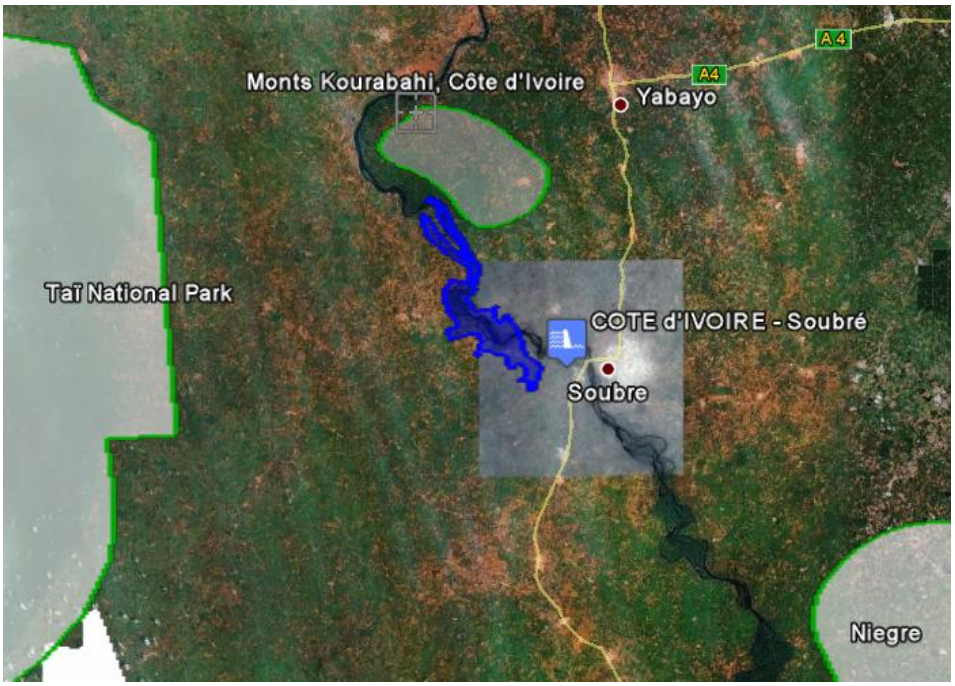


Figure 619: Classified project and zones

2.4.6.8.3. Relief

It consists of different rather uniform hills, of very uneven plateaus that hardly reach 150 to 200 m of altitude and broad, flat and swampy lowlands, of weak descending gradient.

However, the dam is envisaged in a rather flat area. The zone comprises an already strongly developed water network.

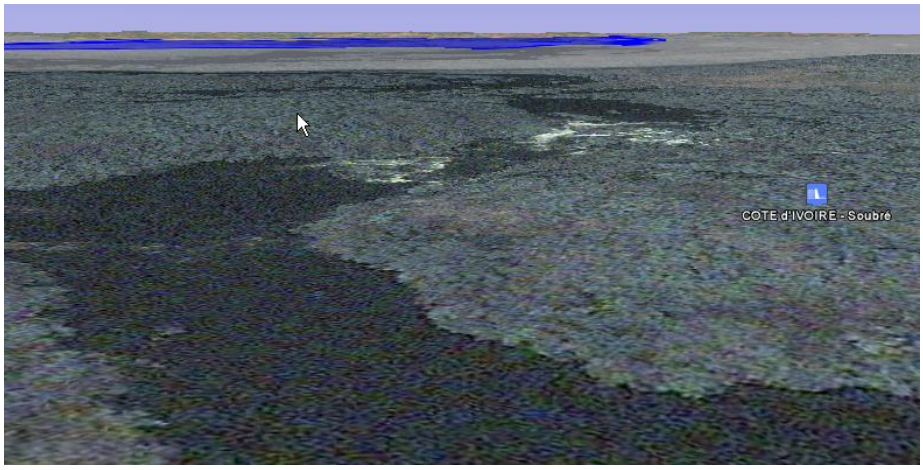


Figure 70: Low relief near the dam

2.4.6.8.4. Climate

The climate of this zone is of hot and wet subequatorial type all year long. It is characterized by a high average annual pluviometry ranging between 1700 and 2100 mm/year. The annual average temperature is of 26°C, with very low amplitude.

2.4.6.8.5. Soils

The soil is of strongly leached lateritic type, the valley soils are occupied by hydromorphic grounds with heterogeneous and rather coarse texture. One finds there also grounds resulting from schists or granites whose texture varies from fine sandy to argillaceous passing by the clay-sandy one.

2.4.6.8.6. Hydrography

Two large rivers cross the area: Sassandra at the East and Cavally at the West. The affluents of these rivers irrigate the entire zone. The system of the rivers is irregular.

2.4.6.8.7. Vegetation and fauna

The south-west of Ivory Coast belongs to sub-region known as high Guinea of the Guinean whole, made up of forest of the mesophile type marked by a procession of specific species such as: *Cola caricifolia, Vepris tabouensis, Androphobie adenostegia*

The information above comes from "the Environmental and Social Management Framework Study (ESMF) - Ivory Coast Electricity Company (SOPIE), February 2009"

- **The National Park of Taï and the Kourabahi Mount:**

The National park of Taï is the largest primary tropical forest under protection of the entire Western African zone. With a surface of approximately 5,340 km², the National park of Taï and the N'Zo Fauna Reserve represent more than 50% of the total surface area of the Western African forest zones placed under statute of strict protection. Because of its great size, the Taï National Park, constitutes a chance to preserve all the genetic reserve of a complex forest ecosystem. Its inscription on the international network list of the Reserves of the Biosphere in 1978 and the World Heritage in 1982 as part of the MAB-UNESCO program shows its importance.

The Taï national park shelters 93% of the species of mammals (140 species of mammals including 8 "endangered species ": Micropotamogale lamottei, Pan troglodytes verus, Liberiictis kuhni, Agelastes meleagridis, Loxodonta Africana, Malimbus ballmanni, Chelonia mydas*, Dermochelys coriacea and 2 particularly "endangered species": Neritina tiassalensis*, Eretmochelys imbricata*) of the West-Guinean forest area. The survival of the majority of the large mammals is not ensured outside the Park. On the 140 species of mammals living in the Taï Park, 12 species, among which Jentink's duiker, the zebra duiker and the Diana monkey are endemic for the area of Western Sierra Leone until the Taï. (http://www.parc-national-de-tai.ci/index.php and of the "Plan of Installation and management of the Taï National park, Ministry of Environment, Waters and Forests, March 2006").

Little information was found on the fauna and the flora of the Kourabahi Mount. However, considering the short distance (- of 25 km) between the Taï National Park and the Kourabahi Mount, one can imagine that the biotopes are strongly similar.

2.4.6.8.8. Population

The inhabitants of the area come in majority from the Bété people.

Figure 71: Population density in the area

The dam is in a densely populated area (128 - 256 inhab/km ²) as the above figure indicates it. The high population density is especially concentrated in the town of Soubré).

2.4.6.8.9. Impact of the project on the environment

The symbols used are presented at the beginning of the chapter and the explanations of the selected choices are presented after the table.

Impact on:	Studies and preparation	Construction	Presence and utilization
Micro climate and air quality	X	N, mi, p, Di, T, Im	-, me, c, Di, L, Sh
Grounds and underground waters		N, mi, p, Di, T, Im	-, me, c, Di, L, Sh
Surface waters		N, me, c, Di, P, Im	N, Ma, c, Di, P, Im
Vegetation	N, mi, c, Di, L, Im	N, Me, c, Di, P, Im	N, Me, c, Di, P, Im
Fauna		N, Me, c, Di, P, Im	N, Me, c, Di, P, Im
Population (moving)	x	N, Ma, c, Di, P, Im	N, Ma, c, Di, P, Im
Socio-economy	N, mi, p, Di, T, Im	N, me, c, Di, P, Im	P, me, c, Di, P, Im
Health and security	x	N, me, c, Di, P, Im	N, me, c, Di, P, Im

2.4.6.8.10. Micro climate and air quality

During the works an impact on the quality of the air will be perceptible in the working areas.

After realization, the expanse of water will influence locally the micro climate especially during the dry season. Retention should play a buffer role in the temperature variations and ensure a high humidity rate.

2.4.6.8.11. Ground and ground water

A modification of the system of the ground water is possible, but unlikely because already today we have a broad river with many branches.

As indicated previously, the flooded zone is already strongly occupied by an important delta. The quantity of ground lost will thus not be very important.

2.4.6.8.12. Surface waters

During the works, a modification of turbidity following the diversion of the river will be noted initially.

With the retention and the deceleration of water, or even its stagnation, there will be important consequences i.e. a modification of the water quality. As a second step, the decomposition of the plants will increase the eutrophication of the waters.

These modifications can have impacts on the vegetation and the entire biodiversity downstream.

2.4.6.8.13. Vegetation

The flooded grounds will be mainly forests and cultivations/fallows. An impact study will have to specify, as accurately as possible, the occupation of the ground impacted by the project.

The impact on the protected areas will be minimal. Indeed, the Taï National Park will not be affected by the influence of the tank neither directly nor in its peripheral area. According to the prefeasibility study, only 60 ha of the protected forest of the Kourabahi Mounts will be affected on the total of 3 350 ha. The dam lake drowns less than 2%.

2.4.6.8.14. Fauna

The construction, and especially the construction of the reservoir will destroy land species, mainly insects and small mammals and especially their biotopes. The impact will be moderate. Then the mode change of the river becoming a lake, will involve a deep change in terms of aquatic ecology. A barrier will settle between the species upstream and those downstream (no upstream movement possible).

As for the vegetation, the species downstream will have to also adapt to a less changing mode and with probably less productive water (after the period of decomposition of the plants).

Fauna and the flora with high value for the biodiversity of this area, where the human pressure is important, are cut out in protected zones and the project will have no or little impact (see conflict with the Kourabahi Mount) on these areas.

2.4.6.8.15. Socio-economical impacts

- **Impact on the population**

The area is strongly populated and populations will be dislodged. In the feasibility study of the project, the population to be moved to this date (2005) was about 3 280 people including 977 indigenous that should be the subject of a relocation in an fitted-out area of the protected forest of "Grah Rapids" (with a surface of 350,000 ha).

After construction, the surface of the lake will also cause many communication problems between the villages and for the inhabitants. In the following figure it is possible to see that the road in the South of the river (towards Gnamandji) will surely be drowned.

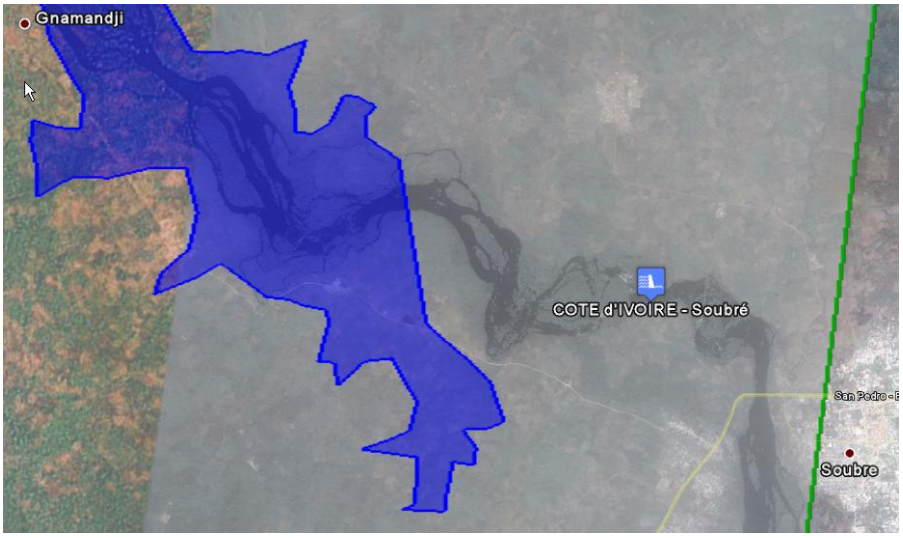


Figure 72: Communication network

- **Economic impact**

During construction, local labor could be hired in the town of Soubré and infrastructures could be created (schools, hospital and playground).

The impact of the dam could make it possible to develop new activities (fishing, irrigated yields,…).

A retention flow passing by the old river bed and feeding the falls of Nawa was estimated to 50 m^3/s which is the low flow average from January to May. This flow will make it possible to preserve cultural habits and the touristic aspects.

The flooded zones include zones of cultivation (cocoa and coffee), important economic losses are to be considered for the local populations.

2.4.6.8.16. Impact on health and safety

The retention flow of 50 m^3/s will make it possible to guarantee the ecological and medical functions of the portion of the river between the spillway and the restitution which is downstream of the town of Soubré.

Accidents during work are more than likely to happen, and the impact of the construction is thus considered as negative. A good prevention will be necessary for the workers and the population.

The presence of the lake can involve a modification of the prevalence of diseases in relation to water (malaria, onchocerciasis,…), which also represents a negative impact in terms of health

2.4.6.8.17. Conclusion

The dam construction will have an unquestionable impact on the environment of the area, in particular in terms of water quality and in human term. However, these impacts remain controllable.

2.4.6.9. HYDROELECTRIC SITE OF KASSA (GUINEA)

2.4.6.9.1. Project description

The project consists in carrying out a dam on the Koba River and a power station of 118 MW to a site located at the border between Guinea and Sierra Leone as well as its connection to the CLSG interconnection between Bumbuna (Sierra Leone) and Linsan (Guinea).

These infrastructures will allow:

- The input of 135 MW of power and 528 GWh of average annual energy on the inter-connected network which in the long term will connect the 3 countries of the Mano River Union (Guinea, Sierra Leone and Liberia);
- The development of the electrical energy exchanges between the two zones A and B of the WAPP;
- The economic attractiveness of a many hydroelectric production sites of Community interest located in the zone B of the WAPP;

2.4.6.9.2. Environment description

Figure 73: Environment description

There are protected areas near the future installation:

- The National park of Outamba-Kilimi (11 km)
- The protected forest of Pinselli (12 km)
- The protected forest of Soyan (15 km)

Figure 74: Population density

The installation is in a little populated area (16 to 32 inhab. /km ²) as the figure 72 indicates it. No village can be seen near the installation.

2.4.6.9.3. Impact of the project on the environment

The lack of information (in particular on the water surface selected) does not make it possible to draw up a matrix of the environmental impacts of the project.

However, as figure 73 suggests it, the valley is rather deep (variation bottom- top of 100 m), the water retention will probably extend along the valley and towards Guinea (in the direction of the flow). Its surface impact will thus be minor.

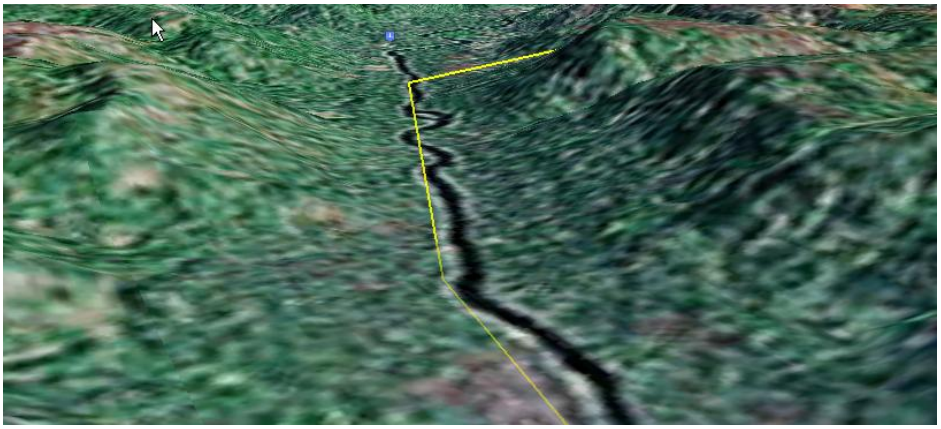


Figure 625: topography of the valley

With this observation on the form of the water expanse, one should check if the classified Forest of Pinselli (at 10 km) is affected.

The construction of this dam will have a significant impact on the aquatic network of the river and the quality of its water in its initial state will be modified. The modification of the aquatic parameters can have a significant impact on the vegetation and the fauna of the area.

2.4.6.9.4. Conclusion

Given the depth of the valley, the water retention will occupy its bottom which should limit the destruction of the habitat surface. However the lack of information on the project does not make it possible to make a complete statement of the impacts. Complementary analyses are to be considered.

2.4.6.10. HYDROELECTRIC SITE OF BOUTOUBRE

No available information for now.

2.4.6.11. HYDROELECTRIC SITE OF TIBOTO

No available information for now.

2.4.6.12. HYDROELECTRIC SITE OF MAMBILLA (NIGERIA)

2.4.6.12.1. Project description

It is a dam of 2600 MW in Mambilla on the Donga River in Nigeria.
The project location is unknown with accuracy.

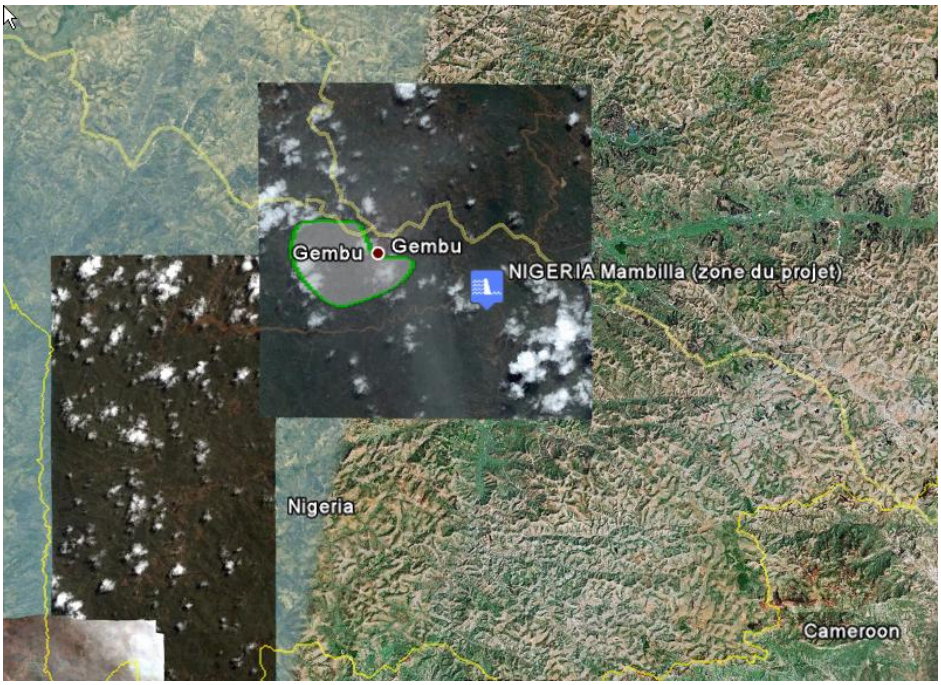


Figure 76: Project location

2.4.6.12.2. Environment Description and population density

According to our information, there is a protected area close to the project: the forest reserve of Gembu. Analyzing the ground occupation, it is visible that the city of Gembu grew importantly and greatly occupied the reserve.

Figure 77: Gembu reserve

The project is located in an area with a high occupation of the ground for agriculture.

Figure 638: Ground occupation

As confirmed by the figure, the project is in a zone where the population density is between 32 and 64 inhab/km².

Figure 79: population density

2.4.6.12.3. Project Impact on the environment

By lack of information (notably on the water detention surface), we cannot build a matrix of environmental impact for the project.

However, according to the document «Detailed engineering design and project management of the proposed 2.600 MW Mambilla hydroelectric power project », the project will cause the displacement of 10 000 to 13 000 persons. These numbers come from a counting carried out from aerial pictures from 1977. A detailed study will have to be performed to update these numbers (they could be higher) and detail the impact of the project.

Given the importance of the population, the lost cultivation areas and the production goods will also be significant, but these parameters are difficult to estimate presently.

Given that the project is not located with accuracy, once the location will be known, it will be necessary to assess the conflict with the forest reserve. But, as abovementioned, its ecological value does not seem to be adapted to its status anymore.

2.4.6.12.4. Conclusion

The project will have an obvious impact on population. This impact is mentioned since the 1977 preliminary studies, with the information collected at that moment. The impacts should be updated with more recent information.

2.4.6.13. HYDROELECTRIC SITE OF BENKONGOR (SIERRA LEONE)

No available information for now.

2.4.6.14. OTHER HYDROELECTRIC INSTALLATIONS

2.4.6.14.1. Adjaralla dam

It is a priority project of WAPP whose commissioning is foreseen for 2015 by CEB. The lake should cover 9500 ha and would have an important environmental and social impact (11 000 persons to move, 2005 estimate), even if they are controllable.

2.4.6.14.2. Hydroelectric site of Félou

The construction of this dam is on-going.

2.4.6.14.3. Hydroelectric site of Sambangalou

The hydroelectric plant of Sambangalou on the Gambia River is part for he OMVG projects. The plant includes a dam, whose commissioning is foreseen for 2017.

The major impact is caused by a detention of 181 km² provoking a population displacement (1320 persons). An important impact has also to be expected downstream on the River and the Niokolo-Koba Park.

2.4.6.14.4. Other projects for OMVS and OMVG

The future production units envisaged in Guinea and Guinea Bissau are listed here below but there is no analysis concerning the social or environmental impact at this stage of the study:

In the frame of OMVG, three sites are foreseen for 2018:

- The run of river plant in Digan, on the Gambia River (in Guinea) ;
- The detention dam of Fello Sounga on the Tominé River (Guinea) ;

- The run of river plant of Saltinho on the Koliba River (Guinea Bissau).

In the frame of OMVS, the most likely projects to be realized at the study horizon are, by priority orders, Koukoutamba, Boureya and Balassa, all three located on the Bafing.

2.4.6.14.5. Kandadji Dam

In Niger, in the River area, the Kandadji dam (energy and irrigation mix) is expected for 2015. The environmental and social study was achieved in 2006 and the detention surface will reach 282 km². The impact will certainly be important bet we did not receive the impact studies or the environment management plans.

2.5. Environmental analysis conclusions

Among the conclusions deriving from the environmental analysis, the following points can be stressed:

The Linsan -Manantali interconnection line has the advantage of allowing the evacuation of the power produced by two hydroelectric projects economically competitive, Boureya and Koukoutamba. However, the layout of this line crosses several protected and sensitive areas on the territory of Mali (national parks of Wongo, of Kouroufing). The protected area is at the border between the republics of Mali and Guinea. An alternative consists in following a longer layout of approximately 150 km to reduce the pressure on the environment in the sensitive areas with an increase the project cost as a consequence.

The impact of the hydroelectric plant project of Souapiti (even with measures of attenuation of great width), will be very important and negative, following the extension of the reserve lake. Indeed, the construction of this work should involve the displacement of 10.000 to 40.000 people. As a consequence, there will be large economic losses for this population (producer's good, fields, houses,…). In particular, the cultivable ground surface which will be lost will be of about 11000 to 13000 ha. This project can however be envisaged if its cost is increased by 15% for the resettlement of the populations and if an environmental action plan is foreseen.

The impact of the hydroelectric project of Ketou (even with important measures of attenuation), will be important and negative, following the extension of the reserve lake. It is hence essential to examine this problem well and to make a detailed environmental and social impact study and to integrate, as from today, an increase of 15% of the costs of construction to integrate the compensation expenses. It is logical to not regard Ketou as a priority project.

The development of the river St Paul can in a first phase being carried out with the hydroelectric sites of St Paul 1B, St Paul 2.

Then, the construction of an additional reservoir St Paul `ultimate Via storage' upstream of the other sites would make it possible in a second phase to increase the productions of the power stations located downstream (1B, 2, Mount Coffee,…). Nevertheless, this last Via dam would have a very wide tank with a very important and negative impact on the environment. It is thus recommended to consider in the priority projects only the dams of the first phase. Since these projects are in the same hydrographical reservoir, and thus dependent, with, in addition, important environmental consequences, a general study is recommended in order to define a global plan of hydroelectric installation of the river and its affluent and thus to minimize the negative impacts.

3. FINANCIAL EVALUATION

3.1. Introduction and rationale

Adequate, secured and affordable electricity supply is a key factor in the socio-economic development of every country. Access to electricity in almost all ECOWAS member countries is very low, ranging from less than 10% in countries like Sierra and Liberia to not about 60% in Ghana. Consequently each country is pursuing its own program to procure the electricity required for its socio-economic development through either generation from its own resources or imports. These individual efforts have been rather expensive, especially for land-locked countries like Burkina Faso and Niger, which are not endowed with appropriate natural resources such as water bodies, gas or liquid fuels for power generation. Moreover, these countries do not have access to seaports and therefore have to truck expensive diesel fuel over long distances at high costs for power generation.

WAPP was established as a specialized legal institution of ECOWAS to establish a unified and competitive regional electricity market in West Africa. This is to be achieved through attracting investments for development of the diverse energy resources of ECOWAS Member States for their collective economic benefit and integration of the operations of the various national power systems of ECOWAS Member States.

The main objective of the WAPP Master Plan Update Study is to integrate the current developments of the power sectors of individual ECOWAS countries into a medium to long term strategy for the expansion of the regional power generation and transmission infrastructure. The Master plan consists of a number of sub-programs involving the interconnection of the transmission systems of various countries and the development of generation facilities within the interconnected zones to supply the demand of the interconnected countries. Successful implementation of the plan will enable countries that are less endowed with generation facilities to benefit from the cheaper energy supply from the generation resources available in the better endowed countries. A larger market/demand will be created by pooling together the demands of the individual countries under the program which will make it possible to exploit the generation resources of the better endowed countries on a large scale and in a cost effective manner. This will enhance the ability of the better endowed countries to attract the capital required for development of the abundant generation resources available in the region for the benefit of all participating countries.

The active support, commitment and participation of the individual countries and funding are required from various international financial institutions to accelerate the implementation of the regional integration program. A necessary requirement for success in the mobilization of funding for the various sub-programs is the establishment of the financial viability of the program. The individual countries will also be incentivized to cooperate and participate actively in the implementation of the program if they see the program as a more reliable and cost effective means to procure energy to meet their individual requirements compared to their own individual ventures.

The purpose of the Financial Evaluation is, accordingly, to investigate and establish the financial viability of the regional program and its ability to bring positive net financial benefits to participating countries.

The regional priority projects are here classified into three categories, made up of:

- The committed projects for which the relevant studies have been done and financing has already been obtained or is about to be obtained
- The planned projects which are already quite detailed and have been subjected to feasibility studies but for which complementary studies are still to be realize and/or for which the majority of the financing still remains to be mobilized;
- The considered projects which were evoked in the collected documents or during the interviews carried out during the data collection missions or which result from the technical and economic studies. These have been confirmed by the technical and economic analysis but their prefeasibility studies are yet to be done or are ongoing.

The decided projects include:

- The "Coastal 330kV Backbone" Project (Cote d'Ivoire – Ghana Togo -Benin - Nigeria
- The CLSG Project (Ivory Coast - Liberia - Sierra Leone - Guinea)
- Mali - Ivory Coast interconnection
- Interconnection Ghana-Burkina Faso
- Generation projects in Senegal: coal power plant in Sendou
- Hydroelectric sites of Gouina and Felou (OMVS)
- Hydroelectric site of Adjaralla in Togo
- Combined cycles of Maria Gleta (Benin) and Aboadze (Ghana)
- OMVG project (225 kV loop and Sambangalou hydro power plant)
- Interconnection Ghana-Burkina Faso-Mali

The planned projects include

- The "Northcore" project
- The North-South 330kV axis in Ghana
- Guinea – Mali interconnection

The Considered Projects include

- The interconnection line between Linsan and Manantali, with the development of the hydro power plants of Boureya and Koukoutamba, and reinforcements of the lines towards Bamako in Mali
- The coal power plant of Salkadamna with interconnection of River and Center-East areas in Niger, and interconnection to Nigeria
- The 225 kV line between Kayes and Tambacounda with the project of Gouina
- Renewable projects: Senegal, Burkina Faso, Mali and Niger
- The interconnection line between Fomi and Boundiali
- The reinforcement of the western part of the OMVG interconnection
- The reinforcement of the CLSG interconnection and/or the interconnection line between Monrovia (Liberia) and San Pedro (Ivory Coast)
- The median backbone project and the hydro plant of Zungeru (Nigeria)
- The 760 kV supergrid in Nigeria

3.2. The evaluation methodology

3.2.1. The Evaluation Approach

The decided projects are at various advanced stages of development and commitments have already been made. WAPP does not therefore require any additional financial evaluation of these projects. The evaluation of the planned generation and considered sub-programs involves a comparison of the net benefits accruing from electricity supply to the two zones of WAPP and the participating WAPP countries under the optimized WAPP programs with those from supply from their individual country programs. This will establish which of the two alternative programs meets the requirements of the individual countries in a more dependable and cost effective manner. In effect, the evaluation investigates the benefits accruing to each zone and the individual countries from supply of electricity "WITHOUT and WITH" the optimized WAPP priority generation and interconnection programs.

WAPP has also decided to adopt the establishment of Specific Purpose Companies as one of the new approaches to facilitate the implementation of the regional projects. It is necessary to establish the financial conditions under which the SPCs will be viable and sustainable.

The evaluation therefore focuses on;

- Assessing the financial viability and superiority of the regional generation and transmission programs over the individual national programs being pursued to provide energy for socio-economic development of the individual countries. This is done by comparing the Net Present Value (NPV), the Benefit to Cost Ratio (B/C) Ratio and the Financial Internal Rate of Return (FIRR) of the regional interconnection and generation program to those of the individual country programs.
- .Assessing the financial viability and sustainability of Specific Purpose Companies (SPC) established to implement the individual sub-programs. The financial viability of the SPC is assessed using the Net Present Value (NPV), the B/C Ratio and the FIRR of the project. Its sustainability is further assessed using the Rate of Return on Average Net Fixed Assets employed each year to assess its profitability, the Current Ratio to assess its liquidity and the Debt Service Cover Ratio to measure its ability to pay maturing loan principal and interest on timely basis
- Assessing the ability of the regional generation and transmission priority investment projects to bring positive economic benefits to all participants, including the energy importing and exporting countries and their utilities. It is important to assess the impact of the program on the individual countries and utilities, even after the viability of the project itself has been established, because the countries have different conditions in terms of energy costs, tariffs and pricing policies, which result in different levels of net benefits accruing from the project to each country and/or utility. The fact that the project is viable does not therefore necessarily mean all the countries will benefit positively from the project. However the countries may support and participate in the projects when the positive financial benefits of the project to the individual countries are established. For each participating country and utility to realize positive financial benefits from the regional project, the sum of transmission service charge for energy imported and the cost of the imported energy should be lower than the prevailing cost of internal supply in the importing country. The exporting country should also be able to recover the cost of generation to serve the export market in full.

- Analyzing the past financial performances of the key utilities to identify and address any constraints that could affect their effective participation in the implementation of the regional priority projects. This is done by analyzing the financial statements of the various utilities over the past three (3) years to assess their performance in terms of:
  - Adequacy of tariffs to cover costs
  - Rate of bill collection and level of Accounts receivable
  - Financial performance indicators including, the Rate of Return on Average Net Fixed Assets employed each year to assess its profitability, the Current Ratio to assess its liquidity and the Debt Service Cover Ratio to measure its ability to pay maturing loan principal and interest on timely basis

The full evaluation is done for considered projects for which data is available, considering that some may not have been subjected to feasibility studies at the moment. In the case of the planned projects, the evaluation will be limited to a sensitivity analysis of the project's viability to delays in commissioning of the project and other relevant variables.

3.2.2. The Evaluation Models

The evaluation is facilitated by the use of three main Excel spreadsheet models that have been developed to assess:

- The past financial performances of the various utilities
- The financial viability of priority projects, financial viability of the SPC and benefits of the project to the participating countries and/or utilities.
- The financial performance and sustainability of the SPC.

3.2.2.1. THE PAST FINANCIAL PERFORMANCE MODEL

This model analyzes the past financial performance of utilities whose financial data are available to the consultant. The purpose of the analysis is to investigate how well each utility was able to meet its financial obligations in the power market in the past. This will serve as an indication of its ability to meet its financial obligation in the future.

The main inputs for the model are data from the past financial statements of the utilities, including the Income Statement, Cash Flows Statements and the Balance Sheet. Data from these reports are used to compute the:

- Billing and Collection Rate using Days Receivables
- Tariff adequacy and profitability using the rate of Return on Average Net Fixed Assets
- Liquidity using the current ratio, and
- Debt Service Cover

3.2.2.2. THE FINANCIAL VIABILITY MODEL

This model has three blocks to assess;

- the financial viability of priority program as a whole,
- the viability of SPCs established to implement sub-programs under the transmission inter- connection program.
- the project's benefits to the participating countries

The inputs for each block consist of;

- Energy Demand by the country
- Energy Supply through internal generation
- Energy exports
- Energy imports
- The capital costs of the sub-program, the operations, maintenance, management and administration costs of the transmission line.

Each block also has outputs, comprising

- The income from the sale of energy, income from energy transmitted based on the transmission service charge and any other direct benefits accruing from the project.
- The net benefit for each year in the planning period is computed as the difference between costs incurred in that year and the benefits. These are used to compute the NPV, the Benefit to Cost Ratio and IRR for purposes of assessing the viability of the project.

3.2.2.3. THE FINANCIAL PERFORMANCE AND SUSTAINABILITY OF THE SPC MODEL

The model used for assessing the financial performance and sustainability of the various SPCs simulates the traditional financial statements of a company, comprising the Income Statement, the Cash Flow Statement and the Balance Sheet. It also computes key financial performance indicators, comprising the Rate of Return on Average Net Fixed Assets employed each year which is used to assess its profitability, the Current Ratio used to assess its liquidity and ability to meet maturing financial obligations on timely basis the company's Debt Service Cover Ratio used to measure its ability to pay maturing loan principal and interest on timely basis.

3.3. Input parameters and assumptions

The inputs used in these analyses are extracted from the results of the technical and economic optimization model. The relevant input parameters are summarized as follows:

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Senegal	2,781	3,110	3,245	3,397	3,836	4,416	4,641	4,885	5,147	5,434	5,757	6,074	6,410	6,770	7,148
Gambia	305	372	427	482	573	726	750	775	799	823	860	890	921	958	994
Guinea Bissau	179	196	207	219	232	245	305	369	436	506	580	611	644	679	715
Guinea	848	1,000	1,159	1,348	1,634	1,842	1,896	1,955	2,014	2,074	2,176	2,247	2,325	2,397	2,469
Sierra Leone	232	305	415	555	671	817	903	945	988	1,037	1,092	1,147	1,208	1,262	1,323
Liberia	55	122	189	262	305	323	342	366	384	415	439	470	500	531	567
Cote d Ivoire	6,179	6,575	6,996	7,456	7,960	8,439	8,937	9,448	9,984	10,546	11,120	11,726	12,346	12,997	13,673
Mali	1,249	1,355	1,518	2,304	2,429	3,152	3,263	3,434	3,539	3,702	3,886	4,074	4,267	4,464	4,665
Burkina Faso	1,118	1,193	1,288	1,395	1,501	1,621	1,746	1,878	2,016	2,167	2,330	2,500	2,682	2,877	3,084
Ghana	10,954	11,586	12,776	13,482	14,209	15,009	15,836	16,723	17,658	18,660	19,722	20,859	22,063	23,347	24,712
Togo	1,084	1,347	1,499	1,636	1,782	1,950	2,130	2,321	2,525	2,715	2,916	3,127	3,349	3,584	3,831
Benin	1,396	1,529	1,628	1,766	1,910	2,049	2,192	2,340	2,494	2,682	2,880	3,088	3,308	3,539	3,783
Niger	677	727	779	832	1,012	1,107	1,525	1,616	1,710	1,805	1,904	2,006	2,110	2,217	2,327
Nigeria	26,568	30,283	34,509	39,329	44,818	51,074	55,779	60,905	66,503	72,606	78,140	85,296	93,103	101,612	110,505
TOTAL	53,625	59,701	66,634	74,462	82,874	92,770	100,245	107,960	116,198	125,173	133,803	144,116	155,235	167,233	179,797

Table 3.1: Base Case Energy Demand Forecast for the various countries - Source: First Intermediate Report of TRACTEBEL Engineering S.A.

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Senegal	Imports	603	748	1,032	-	168	-	-	-	-	-	-	-	-	-	-
	Exports	-	-	-	249	-	1,135	1,037	562	426	490	654	817	969	1,119	1,187
	Internal Generation	2,178	2,363	2,213	3,657	3,668	5,596	5,719	5,470	5,591	5,943	6,437	6,924	7,418	7,933	8,382
Gambia	Imports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Internal Generation	305	372	427	482	573	726	750	775	799	823	860	890	921	958	994
Guinea Bissau	Imports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Internal Generation	179	196	207	219	232	245	305	369	436	506	580	611	644	679	
Guinea	Imports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Internal Generation	848	1,000	1,159	1,348	1,634	1,842	1,896	1,955	2,014	2,074	2,176	2,247	2,325	2,397	2,469
Sierra Leone	Imports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Internal Generation	232	305	415	555	671	817	903	945	988	1,037	1,092	1,147	1,208	1,262	1,323
Liberia	Imports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Internal Generation	55	122	189	262	305	323	342	366	384	415	439	470	500	531	567

Mali

Imports	-	-	-	249	-	1,135	1,037	562	426	490	654	817	969	1,119	1,187
Exports	603	748	1,032	-	168	-	-	-	-	-	-	-	-	-	-
Internal Generation	1,882	2,133	2,591	2,087	2,619	2,062	2,277	2,929	3,171	3,276	3,300	3,329	3,373	3,423	3,557

Table 3.2a: Energy Exchanges & Internal generation (GWh) of various countries WITHOUT the regional projects

Source: Output from the TRACTEBEL Engineering S. A. PRELE Model

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cote d Ivoire	Imports	-	-	-	1,075	876	-	-	-	-	-	-	-	-	-	-
	Exports	433	1,557	289	-	-	2,142	1,657	4,016	3,534	3,397	2,883	2,341	1,782	1,263	726
	Internal Generation	6,731	8,276	7,420	6,527	7,240	10,770	10,770	13,831	13,869	14,292	14,333	14,377	14,422	14,549	14,684
Togo	Imports	-	-	-	1,491	1,500	1,546	175	787	654	963	1,008	873	849	887	468
	Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Internal Generation	193	185	171	175	176	442	442	443	836	1,803	1,962	2,311	2,561	2,761	3,260
Benin	Imports	1,300	1,300	1,300	-	-	428	678	1,230	981	571	630	295	293	312	8
	Exports	-	-	-	1,417	1,388	-	-	-	-	-	-	-	-	-	-
	Internal Generation	42	1	1	3,254	3,374	1,087	68	1,188	1,590	2,118	2,271	2,806	3,029	3,243	3,805
Ghana	Imports	-	447	-	-	-	-	-	1,437	1,002	-	-	-	-	-	-
	Exports	-	-	301	1,617	1,346	1,274	212	-	-	-	94	755	1,262	1,799	1,547
	Internal Generation	10,767	10,706	13,775	16,125	16,796	16,395	16,096	14,999	16,369	18,560	19,899	21,896	23,654	25,433	26,692
Burkina Faso	Imports	433	1,110	590	468	358	1,583	1,694	1,792	1,878	1,919	1,939	1,928	1,902	1,863	1,797
	Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Internal Generation	161	117	113	80	83	85	102	140	196	310	454	634	839	1,069	1,335
Niger	Imports	679	725	771	707	130	105	222	182	-	-	-	-	-	-	-
	Exports									-	-	-	864	1,073	1,416	1,480

	Internal Generation	0	2	8	125	889	1,011	1,311	1,443	1,809	2,137	2,540	2,908	3,227	3,690	3,866
Nigeria	Imports	-	-	-	-	-	-	-	-	-	-	-	864	1,073	1,416	1,480
	Exports	1,979	2,025	2,071	707	130	246	900	1,412	981	56	600	-	-	-	-
	Internal Generation	30,915	34,876	38,999	40,677	45,790	52,714	60,444	64,475	69,511	73,186	78,831	84,962	92,571	100,847	109,753

Table 3.2b: Energy Exchanges & Internal generation (GWh) of various countries WITHOUT the regional projects
Source: Output from the TRACTEBEL Engineering S. A. PRELE Model

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Senegal	Imports	604	748	1,035	-	805	333	978	1,581	1,843	2,140	2,448	2,760	3,098	3,444	3,112
	Exports	-	-	-	136	-	-	-	-	-	-	-	-	-	-	-
	Internal Generation	2,299	2,485	2,332	3,661	3,520	4,203	4,197	3,882	3,882	3,890	3,903	3,907	3,907	3,927	4,628
Gambia	Imports	-	-	-	-	-	-	596	739	763	793	824	837	862	900	874
	Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Internal Generation	305	372	427	482	573	726	155	36	36	37	41	57	64	65	125
Guinea Bissau	Imports	-	-	-	-	-	-	294	396	475	548	623	654	690	733	766
	Exports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Internal Generation	179	196	207	219	232	245	23	0	0	0	6	6	6	7	
Guinea	Imports	-	-	-	-	1,362	1,400	-	-	-	-	-	-	-	-	-
	Exports	-	-	-	-	-	-	174	4,099	5,916	7,625	7,650	7,594	7,512	7,455	7,390
	Internal Generation	848	1,000	1,159	1,348	953	493	1,709	5,872	7,824	9,667	9,781	9,782	9,793	9,797	9,797
Sierra Leone	Imports	-	-	-	-	351	352	-	-	-	-	-	-	-	-	-
	Exports	-	-	-	-	-	-	436	844	843	796	744	690	630	583	525
	Internal Generation	232	305	415	555	466	466	1,361	1,865	1,865	1,865	1,865	1,865	1,865	1,872	1,872
Liberia	Imports	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Exports	-	-	-	-	113	117	107	809	790	759	736	708	1,400	1,866	1,862
	Internal Generation	55	122	189	262	454	454	453	1,229	1,229	1,229	1,229	1,229	1,960	2,471	2,504

Mali	Imports	-	-	-	136	797	1,545	1,154	928	1,016	1,171	1,331	1,449	1,640	1,831	2,007
	Exports	604	748	1,012	-	439	-	-	-	-	-	-	-	-	-	-
	Internal Generation	1,882	2,133	2,571	1,971	1,693	1,693	2,208	2,608	2,628	2,628	2,628	2,680	2,680	2,680	2,703

Table 3.3a: Energy Exchanges & Internal Generation (GWh) of various countries WITH the regional projects (Continued)

		2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cote d Ivoire	Imports	-	-	-	225	80	-	-	-	-	-	-	-	14	-	-
	Exports	1,059	2,412	1,426	-	800	1,465	1,099	2,196	3,160	2,562	2,133	1,954	1,349	713	52
	Internal Generation	7,318	9,157	9,411	6,827	8,060	10,202	10,199	13,572	13,603	13,610	13,701	14,113	14,113	14,113	14,090
Togo	Imports	159	1,181	-	1,474	1,620	1,538	1,366	1,662	1,891	1,785	2,157	-	-	-	-
	Exports	-	-	-	-	-	-	-	-	-	-	-	165	337	209	43
	Internal Generation	175	204	175	165	165	415	768	768	768	768	768	3,375	3,776	3,894	3,898
Benin	Imports	1,055	1,314	1,745	-	-	-	-	-	-	-	-	-	-	-	-
	Exports	-	1,181	-	1,524	3,082	1,199	1,175	1,335	1,234	873	873	633	415	170	20
	Internal Generation	361	4	1	3,373	3,373	3,373	3,373	3,851	3,851	3,851	3,851	3,851	3,851	3,851	3,851
Ghana	Imports	1,232	1,585	2,297	-	-	-	-	-	1,003	1,958	1,335	779	244	-	132
	Exports	-	-	-	727	2,043	3,995	3,183	719	-	-	-	-	-	1,012	-
	Internal Generation	9,759	10,040	10,521	15,869	17,972	19,287	19,287	17,682	16,815	16,821	18,492	20,243	21,988	24,552	24,703
Burkina Faso	Imports	-	1,110	362	572	1,462	1,608	1,724	392	2,126	2,280	2,415	2,612	2,749	1,012	3,104
	Exports	73	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Internal Generation	1,201	117	113	57	57	57	57	57	4	7	4	0	15	20	30
Niger	Imports	677	725	771	707	278	326	551	562	583	745	181	-	-	-	-
	Exports	-	-	-	-	-	-	-	-	-	-	-	488	395	299	218
	Internal Generation	0	2	8	125	736	736	976	1,085	1,087	1,088	1,088	2,587	2,587	2,589	2,589

Nigeria	Imports	-	-	-	-	-	-	-	3,742	2,243	1,195	822	3,141	2,741	4,387	115
	Exports	1,991	2,322	3,772	727	278	326	489	-	-	-	-	-	-	-	-
	Internal Generation	28,941	34,601	40,338	40,650	46,057	52,182	57,261	57,548	64,704	71,973	78,699	82,792	91,184	100,164	111,770

Table 3.3b: Energy Exchanges & Internal Generation (GWh) of various countries WITH the regional projects
Source: Tractebel Engineering PRELE Model output

	Annual Energy Costs of Generation ($/kWh) WITHOUT PROJECTS														
Country/Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	2018	2019	2020	2021	2022	2023	2024	2025
Senegal	0.146	0.146	0.146	0.181	0.181	0.243	0.246	0.252	0.252	0.253	0.255	0.256	0.257	0.259	0.259
Gambia	0.231	0.230	0.227	0.228	0.228	0.145	0.147	0.150	0.153	0.155	0.158	0.161	0.163	0.165	0.168
Guinea Bissau	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231	0.231
Guinea	0.084	0.102	0.114	0.122	0.121	0.127	0.063	0.065	0.055	0.045	0.044	0.044	0.043	0.043	0.043
Sierra Leone	0.058	0.062	0.080	0.097	0.071	0.085	0.049	0.050	0.051	0.053	0.054	0.056	0.058	0.059	0.060
Liberia	0.231	0.231	0.221	0.224	0.102	0.102	0.100	0.097	0.095	0.093	0.091	0.089	0.087	0.085	0.084
Cote d' Ivoire	0.098	0.090	0.082	0.079	0.079	0.081	0.081	0.075	0.075	0.075	0.075	0.075	0.075	0.075	0.075
Mali	0.156	0.159	0.149	0.145	0.145	0.128	0.120	0.109	0.108	0.107	0.107	0.108	0.108	0.109	0.111
Burkina Faso	0.126	0.108	0.105	0.116	0.118	0.119	0.129	0.141	0.145	0.119	0.128	0.142	0.149	0.154	0.156
Ghana	0.096	0.088	0.078	0.086	0.090	0.085	0.084	0.081	0.084	0.085	0.085	0.088	0.088	0.087	0.089
Togo	0.068	0.065	0.060	0.062	0.062	0.105	0.105	0.105	0.118	0.126	0.127	0.128	0.128	0.129	0.126
Benin	0.146	0.146	0.146	0.094	0.094	0.094	0.094	0.094	0.094	0.089	0.089	0.090	0.091	0.091	0.091
Niger	0.113	0.141	0.155	0.103	0.107	0.102	0.135	0.143	0.172	0.187	0.196	0.203	0.205	0.206	0.208
Nigeria	0.087	0.090	0.091	0.092	0.093	0.080	0.074	0.073	0.073	0.075	0.076	0.078	0.080	0.082	0.083

Table 3.4a: Average Costs of energy generation from various countries WITHOUT the program

	Annual Energy Costs of Generation ($/kWh) WITH PROJECTS														
Country/Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Senegal	0.177	0.177	0.177	0.199	0.255	0.242	0.230	0.234	0.234	0.234	0.234	0.234	0.234	0.234	0.240
Gambia	0.231	0.230	0.228	0.228	0.199	0.206	0.114	0.145	0.145	0.147	0.155	0.147	0.144	0.143	0.122
Guinea Bissau	0.231	0.231	0.231	0.231	0.230	0.231	0.231	0.205	0.209	0.212	0.214	0.215	0.216	0.217	0.218
Guinea	0.084	0.102	0.114	0.121	0.103	0.062	0.055	0.045	0.046	0.047	0.047	0.047	0.047	0.047	0.047
Sierra Leone	0.050	0.044	0.035	0.027	0.049	0.049	0.045	0.044	0.044	0.044	0.044	0.044	0.044	0.044	0.044
Liberia	0.231	0.231	0.227	0.228	0.098	0.098	0.098	0.075	0.075	0.075	0.075	0.075	0.063	0.059	0.059
Cote d'Ivoire	0.098	0.092	0.088	0.080	0.080	0.080	0.080	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074
Mali	0.156	0.159	0.149	0.140	0.126	0.126	0.112	0.106	0.107	0.107	0.107	0.107	0.107	0.107	0.107
Burkina Faso	0.169	0.108	0.106	0.091	0.091	0.091	0.091	0.091	0.069	0.107	0.069	0.175	0.175	0.175	0.175
Ghana	0.073	0.065	0.064	0.074	0.077	0.078	0.078	0.077	0.075	0.075	0.077	0.078	0.079	0.081	0.081
Togo	0.119	0.064	0.052	0.047	0.047	0.099	0.094	0.094	0.094	0.094	0.094	0.124	0.125	0.125	0.125
Benin	0.136	0.146	0.146	0.094	0.094	0.094	0.094	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091
Niger	0.175	0.175	0.175	0.103	0.073	0.073	0.122	0.116	0.116	0.116	0.116	0.208	0.208	0.208	0.208
Nigeria	0.078	0.074	0.077	0.077	0.078	0.078	0.078	0.066	0.068	0.069	0.070	0.071	0.072	0.073	0.075

Table 3.4b: Average Costs of energy generation from various countries WITH the program

	REGIONAL TRANSMISSION PROJECTS	Commissioning date	Investment cost ($ m)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Totals
1	**Mali-Ivory Coast (Ferkessedougou -Ségou)**	2012	175	175.0											**175**
2	**Ivory Coast section Laboa-Ferkéssédougou**	2012	100	100.0											**100**
3	**Coastal backbone (section Ghana-Togo-Bénin)**	2013	84	50.4	33.6										**84**
4	**Ghana-Burkina Faso (Bolgatanga -Ouaga)**	2013	74	44.4	29.6										**74**
5	**CLSG Project**	2015	430		129.0	172.0	129.0								**430**
6	**Interconnection Ghana-Burkina Faso-Mali**	2015	230		69.0	92.0	69.0								**230**
7	**Coastal backbone (section Ivory Coast-Ghana)**	2017	57					22.8	34.2						**57**
8	**OMVG Project**	2015-17	575					230.0	345.0						**575**
9	**Interconnection OMVS Tambacounda-Kayes**	2017	65					26.0	39.0						**65**
10	**330kV Axis North-South Ghana**	2018	240					72.0	96.0	72.0					**240**
11	**Guinea-Mali (Fomi-Linsan, -Nzérékoré, -Bamako)**	2018	550					165	220	165					**550**
12	**CLSG Reinforcement (2nd circuit Linsan - Man)**	2018	69					20.7	27.6	20.7					**69**
13	**Northcore project**	2018	540					162.0	216.0	162.0					**540**
14	**Interconnection OMVS Linsan-Manantali 2 circuits**	2018	131					39.3	52.4	39.3					**131**
15	**Reinforcement Soubre-Taabo2/2t**	2018	69					20.7	27.6	20.7					**69**
16	**Reinforcement Manantali-Bamako 1/2t**	2020	70							21.0	28.0	21.0			**70**
17	**Reinforcement Manantali-Bamako (2d) -Sikasso**	2020	84							25.2	33.6	25.2			**84**
18	**Interconnection Fomi-Boundiali**	2020	111							33.3	44.4	33.3			**111**

19	**Reinforcement Linsan-Fomi(second ligne)**	2020	65	19.5	26.0	19.5	**65**
20	**Reinforcement Boundiala-Ferkessedougou-Bobo(1/1t)**	2020	59	17.7	23.6	17.7	**59**
21	**Reinforcement Bobodioulasso-Ouagadougou**	2020	44	13.2	17.6	13.2	**44**
22	**Salkadamna-Niamey (Dossou)**	2020	72	21.6	28.8	21.6	**72**
23	**SalkadamnaCentre East**	2020	61	18.3	24.4	18.3	**61**
24	**Interconnection Liberia-Ivory Coast (San Pedro)**	2020	100	30.0	40.0	30.0	**100**
25	**Median backbone**	2020	238	71.4	95.2	71.4	**238**
26	**Reinforcement OMVG western section Linsan-Kaolack**	>2020	141	42.3	56.4	42.3	**141**
27	**Reinforcement Benin-Nigeria (Sakete-Omotosho)**	>2020	39	11.7	15.6	11.7	**39**
28	**Reinforcement Coastal backbone (Lomé-Sakete)**	>2020	46	13.8	18.4	13.8	**46**

Table 3.5A: Costs estimates and construction schedule of Regional Transmission Projects

Source: Final report

	PROJECT	COUNTRY	Technology	Commissioning Year	MW	Investment Cost ($ m)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Totals
1	Felou	Mali	Hydro	2013	60	170	93.5	76.5										**170**
2	Maria Gleta	Benin	Nat. Gas	2014	450	401	64.16	136.34	200.50									**401**
3	Aboadze	Ghana	Nat. Gas	2014	400	356	56.96	121.04	178.00									**356**
4	Mount Coffee	Liberia	Hydro	2015	66	383		95.8	172.4	114.9								**383**
5	Kaléta	Guinea	Hydro	2015	240	267		67	120	80								**267**
6	Charbon	Senegal	Coal	2016	875	2,532		405.1	810.2	810.2	506.4							**2,532**
7	Gouina(OMVS)	Mali	Hydro	2017	140	329		65.8	65.8	82.3	82.3	32.9						**329**
8	Adjaralla	Togo / Benin	Hydro	2017	147	333		66.6	66.6	83.3	83.3	33.3						**333**
9	Sambangalou(OMVG)	Senegal / Guinea	Hydro	2017	128	433		86.6	86.6	108.3	108.3	43.3						**433**
10	Balassa(OMVS)	Guinea	Hydro	2018	181	171		17.1	34.2	42.8	42.8	17.1	17.1					**171**
11	Badoumbé(OMVS)	Guinea	Hydro	2018	70	197		19.7	39.4	49.3	49.3	19.7	19.7					**197**
12	Fomi	Guinea	Hydro	2018	90	156		15.6	31.2	39	39	15.6	15.6					**156**
13	Soubré	Côte d'Ivoire	Hydro	2018	270	620		62.0	124.0	155.0	155.0	62.0	62.0					**620**
14	Zungeru	Nigeria	Hydro	2018	700	1,077		107.7	215.4	269.3	269.3	107.7	107.7					**1,077**
15	Souapiti	Guinea	Hydro	2018	515	796		79.6	159.2	199.0	199.0	79.6	79.6					**796**
16	Amaria	Guinea	Hydro	2020	300	377				37.7	75.4	94.3	94.3	37.7	37.7			**377**
17	Bumbuna	Sierra	Hydro	2020	350	520				52	104	130	130	52	52			**520**

		Leone																
18	Kassa B	Guinea / Sierra Leone	Hydro	2020	135	214				21.4	42.8	53.5	53.5	21.4	21.4			**214**
19	Koukoutamba(OMVS)	Guinea	Hydro	2020	281	404				40.4	80.8	101.0	101.0	40.4	40.4			**404**
20	Tiboto	Liberia/ Côte d'Ivoire	Hydro	2020	225	578				57.8	115.6	144.5	144.5	57.8	57.8			**578**
21	Salkadamna	Niger	Coal	2020	200	573						91.7	183.4	183.4	114.6			**573**
22	Boureya(OMVS)	Guinea	Hydro	2021	160	373					37.3	74.6	93.3	93.3	37.3	37.3		**373**
23	Grand Kinkon	Guinea	Hydro	2021	291	298					29.8	59.6	74.5	74.5	29.8	29.8		**298**
24	Mambilla	Nigeria	Hydro	2021	2,600	4,000					400.0	800.0	1,000.0	1,000.0	400.0	400.0		**4,000**
25	Digan(OMVG)	Guinea	Hydro	2021	93.3	112					11.2	22.4	28	28	11.2	11.2		**112**
26	Combined cycle	Togo	Nat. Gas	2021	450	401								64.16	136.34	200.50		**401**
27	Wind farm 200 MW	Senegal / Gambia	Wind	2016-2020	200	318						222.6	95.4					**318**
28	Wind farm 300 MW	Nigeria	Wind	2016-2020	300	477								333.9	143.1			**477**
29	Solar PV 150 MW	Burkina Faso	Solar PV	2016-2020	150	549						183	183		183			**549**
30	Solar PV 150 MW	Mali	Solar PV	2016-2020	150	549							183	183	183			**549**
				TOTALS		17,964	214.62	1,422.48	2,303.5	2,242.7	2,431.6	2,388.4	2,665.6	2,169.56	1,447.64	678.8	-	17,964

Table 3.5B: Costs estimates and construction schedule of Regional Generation Projects

INDICATIVE TARIFFS (US CENTS/KWH)

	Ghana	Burkina Faso	Niger	Nigeria	Cote d'Ivoire	Togo	Benin	Senegal	Mali	Liberia	Sierra Leone	Guinea	Guinea Bissau	Gambia
End-User	14.61	25.30	13.54	14.67	19.10	16.00	18.36	24.91	30.57	34.00	34.00	12.40	24.17	24.17
TSC	0.95	1.64	0.88	0.95	1.24	1.04	1.19	1.62	1.99	2.21	2.21	0.81	1.57	1.57
DSC	5.99	10.37	5.55	6.01	7.83	6.56	7.53	10.21	12.53	13.94	13.94	5.08	9.91	9.91
BGT	7.67	13.28	7.11	7.70	10.03	8.40	9.64	13.08	16.05	17.85	17.85	6.51	12.69	12.69
BST*	9.91	17.17	9.19	9.95	12.96	10.86	12.46	16.90	20.74	23.07	23.07	8.41	16.40	16.40

Source: "Comparative study of electricity tariffs used in Africa-December 2009", conducted by the General Secretariat of UPDEA

Note: The analysis into Transmission Service Charge (TSC), Distribution Service Charge (DSC) and Bulk Generation Tariff (BGT) was based on ratios used in Ghana's Tariff Schedule issued in June 2010 by the PURC.

* An increase of 15% increase has been provided to cater annual increase after 2009 across board.

Table 3.6: Indicative Tariffs

3.4. Computation of the generation costs and transmission service charge

SPC are expected to develop and operate various generation and transmission interconnection sub-programs. Some SPCs will be set up to generate and sell energy and others to wheel energy from exporting countries to importing countries. The generation companies must recover their costs through a Bulk Generation Tariff (BGT) and the transmission SPCs will recover theirs costs through a Transmission Service Charge (TSC).

Each company must be able to at least cover its costs in full over the entire life of the project. The BGT and the TSC are accordingly computed as the minimum tariff that will equate the total discounted costs associated with building and operating the facility to the total discounted revenues received from energy sold in the case of the generating SPCs and energy transported in the case of the transmission SPCs.

WAPP prefers a postage stamp pricing methodology for pricing transmission services. This implies that users of the transmission tariff will pay the same price for transmission of each unit (kWh) of energy exchanged, no matter the distance over which the energy is transported. It is assumed that the importing country will bear the transmission service charge.

3.5. Sensivity analysis

The evaluation is based on assumptions about various parameters/inputs that are relevant to the project. These assumptions relate to the future and therefore cannot be predicted with absolute certainty and we acknowledge that there could be changes/deviations of the actual values of these variables from the basic assumptions underlying the analysis. This section assesses the impact of any deviations in these assumptions from the actual values on the viability of the project. It forms a basis for the project implementers to build in contingencies for the management of the project. The issues and factors for which uncertainties will be analyzed include:

- Project Cost

The cost of the project has been estimated using the best information available. The final project cost will be determined after the procurement process, which is expected to be based on International Competitive Bidding. It is therefore possible that actual project cost would be different from the estimates used. There is therefore need to investigate the manner in which such changes in costs will affect the viability of the project. Sensitivities are therefore conducted assess the impact of $\pm$10% and $\pm$15 % variations in costs on the viability of the project.

- Energy Demand Forecast

Scenarios of High Load Growth and Low Load Growth have been computed for the various countries in addition to the Base Case demand forecast. These forecasts results were presented in the supply/demand balance analysis carried out for each country. The impact of these various load growth scenarios on the viability of the priority regional interconnection sub-programs is assessed in this section of the analysis

- Possible Project Delays

Delay in mobilization of funding and inadequate human and material resources are often typical causes of delays in the completion of projects. The impact of 1 and 2 year delay in project implementation is therefore evaluated

- Cost of Energy Supply (esp. Fuel)

Fuel cost is a major part of thermal generation (gas, Light Crude Oil (LCO), Diesel Fuel Oil or HFO. The prices of these fuels are determined internationally and cannot be predicted with certainty. The impact of fuel costs on the viability of the sub-programs is then investigated.

- Discount Rate

The discount rate is an indicator of the cost of capital and perception of the risk associated to the project by the investor. It is used to determine the value of a stream of future cash-flows into the base year's worth. A high discount rate indicates a high opportunity cost of capital to the investor and/or high risk associated with the project. It could be based on any of prevailing general financial market conditions or actual weighted average cost of capital mobilized for the project. In view on the number of countries involved in the project and the diversity in financial market conditions of these countries, it could be difficult to attempt to compute a discount rate on the basis above. The analysis therefore assumes a discount rate of 10% and conducts sensitivity of the project benefits to rates of 8% and 12%.

3.6. Evaluation results

3.6.1. Past Financial Performance of Utilities

In appendix summaries of the past financial performance indicators of seven (7) utilities in the region are presented. This section uses the Rate of Return on Average Net Fixed Assets employed, the Current Ratio, the Debt Service Cover and the Days Receivables for each utility to determine the ability of the utilities to;

- recover their costs in full with a return on investments
- meet maturing operating expenses on timely basis
- service their long term debt, and
- collect maturing power sales bills on timely basis.

Generally, a high and positive rate of return on net fixed assets shows a healthy profit level of the utilities. A current ratio of 1.2 and a debt service cover of 1.3 are used as benchmarks, based on financial covenants included in the financing agreement with the World Bank for the Costal Backbone Project. A lower level of receivables is also desirable, and 30 days is used as the benchmark on the basis of the billing cycle of most utilities, which is monthly.

The utilities and countries analyzed are CEB of Togo/Benin, SONABEL of Burkina Faso, SENELEC of Senegal, NIGELEC of Niger, EDM-SA of Mali, VRA of Ghana and EDG of Guinea.

CEB – FINANCIAL SUMMARY

	2009	2008	2007
Return on Average Net Fixed Assets(B/A)	4.3%	1.8%	-3.3%
Current ratio (D/E)	1.45	2.65	2.87
Debt Service Cover Ratio (B/(F+H))	0.46	0.37	(0.64)
Days Receivables	298	201	206

Table 3.7: Financial Performance of CEB – TOGO/BENIN

CEB recorded increases in profitability over the entire period due mainly to un-explained other operating income. This led to corresponding increases in ability to service its long term debt. High levels of uncollected power sales bills however appears to have adversely affected its ability to meet maturing current liabilities. CEB appears therefore to have problems with both profitability on power activities, an indication of inadequate tariffs, and collection of power sales bills. These resulted in low debt service cover of not more than .46 compared to the desired minimum industry level of about 1.3.

SONABEL – FINANCIAL SUMMARY

	2009	2008	2007
Return on Average Net Fixed Assets(B/A)	3.3%	0.9%	1.0%
Current ratio (D/E)	2.73	2.38	1.97
Debt Service Cover Ratio (B/(F+H))	0.66	0.32	0.32
Days Receivables	132	134	

Table 3.8: Financial Performance of SONABEL – BURKINA FASO

SONABEL recorded lower power sales in 2009 compared to 2008 but increased profitability over the same period also due mainly to un-explained other operating income. The company has a moderately high level of receivables, even though this does not appear to affect its ability to meet maturing liabilities including long term debt on timely basis. Its long term debt service capability at .66 is low compared to the minimum debt service cover of about 1.3 desired for the industry.

SENELEC FINANCIAL SUMMARY

	2010	2009	2008	2007
Return on Average Net Fixed Assets(B/A)	-22.8%	2.5%	-4.3%	-1.7%
Current ratio (D/E)	0.97	1.14	1.11	1.02
Debt Service Cover Ratio (B/(F+H))	(8.59)	0.97	(1.66)	(1.87)
Days Receivables	271	231	207	173

Table 3.9: Financial Performance of SENELEC- SENEGAL

SENELEC is characterized by low operating profits with high and increasing levels of accounts receivable leading to low debt servicing capability. In 2010 in particular, the company would not have been able to service its long term debt on timely basis, unless it used other means such as retained cash, and/or support from a third party.

NIGELEC- NIGER

The table below shows a considerable decline in the company's profits from 2008 to 2009. Details in the relevant appendix show that this is the result of a high significant (27%) in operating costs compared to only 11% increase in revenues. In spite of some improvement in revenue collection the decline in operating profit led to a reduction in the utilities ability to service both short and long term maturing liabilities. NIGELEC appears to be in a situation where tariffs are not adjusted sufficiently to cover increases in operating costs.

NIGELEC FINANCIAL SUMMARY

	2009	2008	2007
Return on Average Net Fixed Assets(B/A)	2.9%	19.7%	
Current ratio (D/E)	0.90	0.95	
Debt Service Cover Ratio (B/(F+H))	0.90	2.69	
Days Receivables	162	197	

Table 3.10: Financial Performance of NIGELEC - NIGER

The utility's operating profit improved over the entire period. Between 2008 and 2009 for example, details in the appendix shows that the utility recorded over 100% increase in revenues but a slight reduction in operating costs. This improved the company's ability to meet maturing short and long term liabilities, even though its ratios still remained significantly lower than the industry standard.

FINANCIAL SUMMARY OF EDM

	2009	2008	2007
Return on Average Net Fixed Assets(B/A)	0.2%	-2.3%	-2.6%
Current ratio (D/E)	1.02	0.99	0.92
Debt Service Cover Ratio (B/(F+H))	0.11	(1.71)	(2.19)
Days Receivables	139	143	137

Table 3.11: Financial Performance of EDM-SA –MALI

VRA – GHANA

The table below shows VRA on a path of recovery from heavy losses in 2007 to 2009, even though the utilities profitability is still low.

Details in the Appendix show that this is due largely to increased sales revenue, which virtually doubled from 2007 to 2009 as against only about 10% increase in operating expenses. The poor operating margin, coupled with high levels of accounts receivables exposed the utility to the possibility of default in long term debt servicing, especially between 2007 and 2008.

VRA FINANCIAL SUMMARY	**2009**	**2008**	**2007**
	2009	2008	2007
Return on Average Net Fixed Assets(B/A)	0.51%	-4.38%	-16.80%
Current ratio (D/E)	1.49	1.55	1.13
Debt Service Cover Ratio (B/(F+H))	0.31	(3.85)	(11.24)
Days Receivables	254	240	176

Table 3.12: Financial Performance of Table 6.13: Financial Performance of VRA-GHANA

A major cause of this state of affairs is the massive load shedding that the utility went through in 2007 as a result of low rainfall which reduced the available hydro energy for sale significantly. This was not matched by a corresponding reduction in costs because of the predominantly fixed nature of the hydro costs and the fact that additional thermal generation was procured to meet part of the shortfall in supply, which is more expensive.

The table below shows that EDG incurred operating losses for all the years under review, even though with a decreasing trend due to unexplained other income. These financial loses, coupled with a very high level of accounts receivable put the utility in a situation of possible default in meeting maturing long term debt service, even though its ability to meet maturing current liabilities was reasonably high during the entire period. The situation of the utility could be an indication of inadequate tariffs and poor bill collection rate.

EDG FINANCIAL SUMMARY

	2009	2008	2007
Return on Average Net Fixed Assets(B/A)	-1.5%	-2.5%	-4.1%
Current ratio (D/E)	1.24	1.28	1.29
Debt Service Cover Ratio (B/(F+H))	(0.73)	(2.09)	(4.45)
Days Receivables	346	307	346

Table 3.13: Financial Performance of EDG - GUINEA

3.6.2. Financial Performance of Project, the SPC, WAPP Zones and their Countries

There are only limited interconnections and electricity exchanges between WAPP countries at the moment. This situation is likely to persist until the transmission programs planned by WAPP to ultimately link all WAPP countries, as presented in Table 3.5 are successfully implemented. Existing exchanges are restricted within two main blocks in the region classified as Zone A and Zone B. Zone A countries are La Cote d'Ivoire, Ghana, Togo, Benin, Nigeria, Niger and Burkina Faso and Zone B countries are La Cote d'Ivoire, Liberia, Sierra Leone, Guinea, Mali, Guinea Bissau and Senegal. La Cote d'Ivoire overlaps the two zones.

This section compares the net benefits accruing to each zone and each member country under two scenarios, namely;

- The current limited interconnections persist with limited exchanges occurring between countries that are interconnected while countries that are not interconnected continue to depend on their own internal generation resources to meet their demand. This is the current situation in the region. It is labeled the WITHOUT WAPP INTERCONNECTON PROJECTS (WITHOUT) Scenario.
- The planned power pool situation where the optimized WAPP priority projects are implemented and countries can avail themselves with supply from any member of the WAPP. This is the WITH WAPP INTERCONNECTION PROJECTS (WITH) Scenario.

We find it expedient to do the analysis for the two distinct zones even under the scenario where the full interconnection is accomplished in order to be able to compare the two scenarios and assess which alternative brings higher financial benefits to each zone as well as the individual countries in the zone.

3.6.2.1. FINANCIAL PERFORMANCE OF ZONE A AND ITS COUNTRIES

- La Cote d'Ivoire, Ghana Togo and Benin are fully inter-connected
- Nigeria and Niger are interconnected.
- There will be only limited exchanges from Nigeria to Benin (150 MW) till 2012 when it is expected that Nigeria will be fully synchronized with the rest of La Cote d'Ivoire, Ghana, Togo and Benin
- Limited exchanges between La Cote d'Ivoire and Burkina Faso and Ghana and some border towns in Burkina Faso.
- Nigeria, Ghana and La Cote d'Ivoire are the exporters of energy to the rest of the countries.

Table 3.1 above shows the demand for electricity and Table 6.2 shows the energy supply mix including internal generation, imports and exports for the various countries. The cost of imports comprises the average cost of energy production from the exporting country (Table 3.4) plus the transmission service charge, computed as $0.0169/kWh as shown in Appendix. The estimated Bulk Supply Sales tariffs for the various countries are presented in Table 3.6. Based on these inputs, the detail analysis in respect of the Project, the Zone and each country under the zone is given in appendix. The results are summarized in the Table below.

SUMMARY OF RESULTS - ZONE A (WITHOUT CASE)				SUMMARY OF RESULTS - ZONE A (WITH CASE)		
Entity	**NPV ($m)**	**BC Ratio**		**Entity**	**NPV ($m)**	**BC Ratio**
All Countries	10,263	1.16		**All Countries**	18,736	1.32
Ghana	956	1.08		**Ghana**	3,260	1.34
Burkina Faso	265	1.13		**Burkina Faso**	1,017	1.74
Niger	(694)	0.65		**Niger**	(389)	0.73
Nigeria	5,776	1.15		**Nigeria**	9,271	1.27
Cote d'Ivoire	3,063	1.44		**Cote d'Ivoire**	3,639	1.51
Togo	(132)	0.93		**Togo**	(15)	0.99
Benin	243	1.13		**Benin**	1,034	1.92

Table 3.14: Summary of Evaluation Results (Zone A)

PERFORMANCE OF THE ZONE AND INDIVIDUAL COUNTRIES

The NPV of net benefits from electricity supply activities in the entire Zone A is US$18,736 million, compared to US$10,263 million without the project. It means an increase of US$ 8,437 million in the NPV for the zone.

Nigeria, Ghana, Cote d'Ivoire, Burkina Faso and Benin all recorded higher positive NPVs with the project. Even Niger and Togo which still recorded negative NPVs showed improvements in their results in the case WITH the project.

The Benefit to Cost ratio follows the same trends.

3.6.2.2. FINANCIAL PERFORMANCE OF ZONE B COUNTRIES & THE ZONE AS A WHOLE

Without the WAPP Regional Interconnection

The only exchanges in Zone B occur within the OMVS group under which arrangement the output of the Manantali hydro project in Mali is shared among Mali, Senegal and Mauritania. The interconnection associated with this project will enable Senegal to export energy to Mali from about 2016 onwards. It is also expected that La Cote d'Ivoire will be connected to Mali in 2014.

Appendix 6.4 shows the detail analysis in respect of the Zone and each country, based on the inputs from the relevant tables discussed under Zone A. The results are summarized in the Table below.

SUMMARY OF RESULTS - ZONE B (WITHOUT CASE)				SUMMARY OF RESULTS - ZONE B (WITH CASE)		
Entity	**NPV ($m)**	**BC Ratio**		**Entity**	**NPV ($m)**	**BC Ratio**
All Countries	3,576	1.72		**All Countries**	7,315	1.36
Senegal	(2,074)	0.77		**Senegal**	(981)	0.86
Mali	1,657	1.52		**Mali**	2,499	2.05
Liberia	246	1.82		**Liberia**	395	2.03
Sierra Leone	960	3.53		**Sierra Leone**	1,050	3.64
Cote d'Ivoire	3,073	1.44		**Cote d'Ivoire**	3,639	1.51
Guinea	36	1.03		**Guinea**	140	1.07
Guinea Bissau	(40)	0.92		**Guinea Bissau**	82	1.23
Gambia	(117)	0.88		**Gambia**	133	1.19

Table 3.15: Summary of Evaluation Results (Zone B)

It shows that the NPV of the net benefits accruing from electricity supply activities for the Zone as a whole WITHOUT the WAPP regional interconnection projects is US$3,576 million compared to US$7,315 million WITH the project, representing an improvement in net benefits of US$3,739 million when the WAPP priority program is implemented. All the countries in the zone recorded improvements in their NPVs.

3.6.3. Financial Viability and Sustainability of SPCs

The approach adopted for implementation of the priority transmission line projects approved in the 2004 Master Plan required each participating country to develop and finance the segment of the line falling within its geographical boundaries. Two major weaknesses of this implementation approach have been identified as;

- challenges associated coordination and management of the implementation of projects when multiple countries and/or utilities are involved, and
- non convergence of objectives and priorities of participating countries

WAPP has therefore decided to adopt the SPC approach for project implementation in order to curtail project implementation delay. This new approach which places the responsibility for project implementation on a single legally recognized entity whose members will be committed to the common mission and objective of implementing the project on time and within budget. The approach has already been used to implement the OMVS project successfully and arrangements are far advanced to use the same approach for the CLSG inter-connector.

The analysis has done for projects which involve more than two participating countries. This is because the implementation of projects involving only one or two states is not prone to the problems listed above.

The selected projects are;

- The Guinea – Mali Interconnection
- The Cote d'Ivoire Liberia Interconnection
- The "North Core" Project
- The Mali-Cote d'Ivoire interconnection
- The hydroelectric project of Grand Kinkon (Guinea)
- The hydroelectric project of Koukoutamba (OMVS)
- The hydroelectric project of Mambilla (Nigeria)
- The hydroelectric project of Souapiti (Guinea)
- The combined cycle project in Togo
- The wind farm project in Gambia and Senegal
- The solar projects in Mali and Burkina Faso

The details of the analyses of the viability and sustainability of the various SPCs are presented in appendix. This section presents a summary of the key performance indicators, interpretation of these results and the outcome of the sensitivity analyses.

- GUINEA- MALI TRANSMISSION LINE SPC

Table 3.16 below presents a summary of the performance indicators of the Guinea-Mali Transmission Line SPC

	KEY FINANCIAL PARAMETERS				KEY FINANCIAL INDICATORS			
Variable	**Project Cost**	**Completion Period**	**Repayment Period**	**Discount Rate**	**Ro ANFA**	**Cur Ratio**	**DSCR**	**NPV**
	(US$ m.)	(yrs)	(yrs)	(%)	%			(US$ m)
Base Case	240.0	5	10	10%	16.4%	10.51	1.55	234.3
+10% Cost Overrun	264.0	5	10	10%	14.5%	8.92	1.37	220.2
+15% Cost Overrun	276.0	5	10	10%	13.7%	8.2	1.29	213.2
-10% Cost Underrun	216.0	5	10	10%	18.7%	12.5	1.77	248.4
-15% Cost Underrun	204.0	5	10	10%	20.1%	13.6	1.90	255.5
+1 yr Delay	252.0	6	10	10%	16.6%	10.77	1.57	236.3
+2 yr Delay	264.0	7	10	10%	17.2%	11.4	1.63	240.8
8% Discount Rate	240.0	5	10	8%	16.4%	10.51	1.55	258.5
12% Discount Rate	240.0	5	10	12%	16.4%	10.5	1.55	214.4

Table 3.16: Summary of Financial Results and Sensitivity Analysis (Guinea-Mali)

This SPC also records positive NPV of US$ 42 million at the base discount rate of 10%, The NPV is not too sensitive to the discount rate as the NPV changes to US$40 million at a discount rate of 8% and to US$39 million at a discount rate of 12%. Although the return on Average net fixed assets is positive, all the other indicators show low and positive results with the best performance occurring when the project cost is reduced by 15%. The worst performance occurs when the project costs increase by 15%. The SPC is therefore a viable entity

- The “North Core” TRANSMISSION LINE SPC

Table.3.17 below presents a summary of the performance indicators of the “North Core” Transmission Line SPC. It shows that the project is also viable because all the indicators are positive.

NORTH CORE - SUMMARY OF FINANCIAL RESULTS (BASE CASE AND SENSITIVITY ANALYSIS)

	KEY FINANCIAL PARAMETERS				KEY FINANCIAL INDICATORS			
Variable	**Project Cost**	**Completion Period**	**Repayment Period**	**Discount Rate**	**Return on ANFA**	**Current Ratio**	**DSCR**	**NPV**
	(US$ m)	**(yrs)**	**(yrs)**	**(%)**	**%**			**(US$ m)**
Base Case	540.0	5	10	10%	17.75%	9.69	1.59	448.20
+10% Cost Overrun	594.0	5	10	10%	15.6%	8.17	1.40	418.9
+15% Cost Overrun	621.0	5	10	10%	14.7%	7.5	1.32	404.3
-10% Cost Underrun	486.0	5	10	10%	20.3%	11.5	1.81	477.5
-15% Cost Underrun	459.0	5	10	10%	21.9%	12.6	1.95	492.1
+1 yr Delay	567.0	6	10	10%	15.6%	7.86	1.38	412.6
+2 yr Delay	594.0	7	10	10%	15.2%	7.7	1.35	409.0
8% Discount Rate	540.0	5	10	8%	17.7%	9.69	1.59	504.4
12% Discount Rate	540.0	5	10	12%	17.7%	9.7	1.59	401.9

Table 3.17: Summary of Financial Results and Sensitivity Analysis (North Core)

This SPC also records positive NPV of US$ 448 Million at the base discount rate of 10%, The NPV is sensitive to the discount rate as the NPV increases to US$504 Million at a discount rate of 8% and decreases to US$402 million at a discount rate of 12%. All the other indicators are positive with the best performance occurring when the project cost is reduced by 15%. The worst performance occurs when the project costs increase by 15%. The SPC is therefore a viable entity.

- COTE D’IVOIRE- LIBERIA TRANSMISSION LINE SPC

Table 3.18 below presents a summary of the performance indicators of the Cote d’Ivoire-Liberia Transmission Line SPC. The results show that the project is not viable because all the indicators are negative.

IVORY COAST - LIBERIA - SUMMARY OF FINANCIAL RESULTS FOR THE BASE CASE AND SENSITIVITY ANALYSIS

	KEY FINANCIAL PARAMETERS				KEY FINANCIAL INDICATORS			
Variable	**Project Cost**	**Completion Period**	**Repayment Period**	**Discount Rate**	**Return on ANFA**	**Current Ratio**	**DSCR**	**NPV**
	(US$ m)	**(yrs)**	**(yrs)**	**(%)**	**%**			**(US$ m)**
Base Case	110.0	4	10	10%	0.7%	(1.45)	0.09	(14.0)
+10% Cost Overrun	121.0	4	10	10%	0.2%	(1.95)	0.03	(19.6)
+15% Cost Overrun	126.5	4	10	10%	0.0%	(2.17)	0.01	(22.3)
-10% Cost Underrun	99.0	4	10	10%	1.4%	(0.8)	0.15	(8.4)
-15% Cost Underrun	93.5	4	10	10%	1.7%	(0.5)	0.19	(5.6)
+1 yr Delay	115.5	5	10	10%	0.5%	(1.67)	0.06	(16.2)
+2 yr Delay	121.0	6	10	10%	0.2%	(1.8)	0.04	(17.3)
8% Discount Rate	110.0	4	10	8%	0.7%	(1.45)	0.09	(17.3)
12% Discount Rate	110.0	4	10	12%	0.7%	(1.5)	0.09	(11.2)

Table 3.18: Summary of Financial Results and Sensitivity Analysis of Ivory Coast-Liberia SPC

	KEY FINANCIAL PARAMETERS				KEY FINANCIAL INDICATORS			
Variable	**Project Cost**	**Completion Period**	**Repayment Period**	**Discount Rate**	**Return on ANFA**	**Current Ratio**	**DSCR**	**NPV**
	(US$ m)	**(yrs)**	**(yrs)**	**(%)**	**%**			**(US$ m)**
Base Case	298.0	6	10	10%	17.4%	26.08	3.12	170.1
+10% Cost Overrun	327.8	6	10	10%	15.6%	22.58	2.80	162.34
+15% Cost Overrun	342.7	6	10	10%	14.9%	21.05	2.67	158.44
-10% Cost Underrun	268.2	6	10	10%	19.5%	30.37	3.51	177.93
-15% Cost Underrun	253.3	6	10	10%	20.8%	32.89	3.74	181.83
+1 yr Delay	312.9	7	10	10%	16.6%	24.46	2.97	166.71
+2 yr Delay	327.8	5	10	10%	16.2%	24.07	2.92	165.84
8% Discount Rate	298.0	6	10	8%	17.4%	26.08	3.12	214.67
12% Discount Rate	298.0	3	10	12%	17.4%	26.08	3.12	136.18

Table 3.19: Summary of Financial Results and Sensitivity Analysis of Grand Kinkon Hydro Project (Guinea)

The Grand Kinkon Hydro project records positive NPV of US$ 170 Million at the base discount rate of 10%, The NPV is sensitive to the discount rate as the NPV increases to US$215 Million at a discount rate of 8% and decreases to US$136 million at a discount rate of 12%. All the other indicators are positive with the best performance occurring when the project cost is reduced by 15%. The worst performance occurs when the project costs increase by 15%. The SPC is therefore a viable entity.

	KEY FINANCIAL PARAMETERS				KEY FINANCIAL INDICATORS			
Variable	**Project Cost**	**Completion Period**	**Repayment Period**	**Discount Rate**	**Return on ANFA**	**Current Ratio**	**DSCR**	**NPV**
	(US$ m)	**(yrs)**	**(yrs)**	**(%)**	**%**			**(US$ m)**
Base Case	404.0	6	10	10%	15.1%	21.56	2.71	191.2
+10% Cost Overrun	444.4	6	10	10%	13.6%	18.46	2.43	180.62
+15% Cost Overrun	464.6	6	10	10%	12.9%	17.12	2.31	175.33
-10% Cost Underrun	363.6	6	10	10%	17.0%	25.34	3.05	201.76
-15% Cost Underrun	343.4	6	10	10%	18.1%	27.56	3.26	207.05
+1 yr Delay	424.2	7	10	10%	14.4%	20.13	2.58	186.55
+2 yr Delay	444.4	5	10	10%	14.1%	19.78	2.54	185.36
8% Discount Rate	404.0	6	10	8%	15.1%	21.56	2.71	241.45
12% Discount Rate	404.0	3	10	12%	15.1%	21.56	2.71	152.90

Table 3.20: Summary of Financial Results and Sensitivity Analysis of Koukoutamba Hydro Project (Guinea)

The Koukoutamba Hydro project records positive NPV of US$ 191 Million at the base discount rate of 10%, The NPV is sensitive to the discount rate as the NPV increases to US$241 Million at a discount rate of 8% and decreases to US$153 million at a discount rate of 12%. All the other indicators are positive with the best performance occurring when the project cost is reduced by 15%. The worst performance occurs when the project costs increase by 15%. This SPC project is therefore a viable entity.

MAMBILLA HYDRO PROJECT	SUMMARY OF FINANCIAL RESULTS (BASE CASE AND SENSITIVITY ANALYSIS)							
	KEY FINANCIAL PARAMETERS				**KEY FINANCIAL INDICATORS**			
Variable	**Project Cost**	**Completion Period**	**Repayment Period**	**Discount Rate**	**Return on ANFA**	**Current Ratio**	**DSCR**	**NPV**
	(US$ m)	**(yrs)**	**(yrs)**	**(%)**	**%**			**(US$ m)**
Base Case	4,000.0	6	10	10%	20.6%	32.45	3.70	2,833.8
+10% Cost Overrun	4,400.0	6	10	10%	18.5%	28.37	3.33	2,729.16
+15% Cost Overrun	4,600.0	6	10	10%	17.6%	26.59	3.17	2,676.82
-10% Cost Underrun	3,600.0	6	10	10%	23.1%	37.44	4.15	2,938.52
-15% Cost Underrun	3,400.0	6	10	10%	24.6%	40.38	4.41	2,990.86
+1 yr Delay	4,200.0	7	10	10%	19.6%	30.56	3.52	2,787.91
+2 yr Delay	4,400.0	5	10	10%	19.2%	30.11	3.47	2,776.16
8% Discount Rate	4,000.0	6	10	8%	20.6%	32.45	3.70	3,572.66
12% Discount Rate	4,000.0	3	10	12%	20.6%	32.45	3.70	2,270.09

Table 3.21: Summary of Financial Results and Sensitivity Analysis of Mambilla Hydro Project (Nigeria)

The Mambilla Hydro project records positive NPV of US$ 2,834 Million at the base discount rate of 10%, The NPV is also sensitive to the discount rate as the NPV increases to US$3,573 Million at a discount rate of 8% and decreases to US$2,270 million at a discount rate of 12%. All the other indicators are positive with the best performance occurring when the project cost is reduced by 15%. The worst performance occurs when the project costs increase by 15%. This Mambilla SPC project is therefore a viable entity.

SOUAPITI HYDRO PROJECT	SUMMARY OF FINANCIAL RESULTS (BASE CASE AND SENSITIVITY ANALYSIS)							
	KEY FINANCIAL PARAMETERS				**KEY FINANCIAL INDICATORS**			
Variable	**Project Cost**	**Completion Period**	**Repayment Period**	**Discount Rate**	**Return on ANFA**	**Current Ratio**	**DSCR**	**NPV**
	(US$ m)	**(yrs)**	**(yrs)**	**(%)**	**%**			**(US$ m)**
Base Case	796.0	6	10	10%	35.1%	61.35	6.30	1,166.7
+10% Cost Overrun	875.6	6	10	10%	31.8%	54.64	5.70	1,143.81
+15% Cost Overrun	915.4	6	10	10%	30.3%	51.72	5.44	1,132.36
-10% Cost Underrun	716.4	6	10	10%	39.3%	69.56	7.04	1,189.64
-15% Cost Underrun	676.6	6	10	10%	41.7%	74.38	7.48	1,201.10
+1 yr Delay	835.8	7	10	10%	33.5%	58.25	6.02	1,156.67
+2 yr Delay	875.6	5	10	10%	32.9%	57.50	5.94	1,154.10
8% Discount Rate	796.0	6	10	8%	35.1%	61.35	6.30	1,441.81
12% Discount Rate	796.0	6	10	12%	35.1%	61.35	6.30	953.08

Table 3.22: Summary of Financial Results and Sensitivity Analysis of Souapiti Hydro Project (Guinea)

The Souapiti Hydro project records positive NPV of US$ 1,167 Million at the base discount rate of 10%, The NPV is also sensitive to the discount rate as the NPV increases to US$1,442 Million at a discount rate of 8% and decreases to US$953 million at a discount rate of 12%. All the other indicators are positive with the best performance occurring when the project cost is reduced by 15%. The worst performance occurs when the project costs increase by 15%. This Souapiti hydro project is therefore a viable entity.

COMBINE CYCLE NG PROJECT	SUMMARY OF FINANCIAL RESULTS (BASE CASE AND SENSITIVITY ANALYSIS)							
	KEY FINANCIAL PARAMETERS				**KEY FINANCIAL INDICATORS**			
Variable	**Project Cost**	**Completion Period**	**Repayment Period**	**Discount Rate**	**Return on ANFA**	**Current Ratio**	**DSCR**	**NPV**
	(US$ m)	**(yrs)**	**(yrs)**	**(%)**	**%**			**(US$ m)**
Base Case	401.0	3	10	10%	75.9%	43.32	6.99	1,684.5
+10% Cost Overrun	441.1	3	10	10%	68.4%	38.69	6.31	1,664.14
+15% Cost Overrun	461.2	3	10	10%	65.2%	36.67	6.01	1,653.98
-10% Cost Underrun	360.9	3	10	10%	85.0%	48.99	7.84	1,704.78
-15% Cost Underrun	340.9	3	10	10%	90.4%	52.32	8.33	1,714.94
+1 yr Delay	421.1	4	10	10%	72.6%	41.17	6.67	1,675.45
+2 yr Delay	441.1	5	10	10%	70.1%	38.95	6.34	1,665.35
8% Discount Rate	401.0	3	10	8%	75.9%	43.32	6.99	2,108.04
12% Discount Rate	401.0	3	10	12%	75.9%	43.32	6.99	1,370.02

Table 3.23: Summary of Financial Results and Sensitivity Analysis of Combine Cycle NG Project (Togo)

The NG Combine Cycle project records positive NPV of US$1,685 Million at the base discount rate of 10%, The NPV is also sensitive to the discount rate as the NPV increases to US$2,108 Million at a discount rate of 8% and decreases to US$1,370 million at a discount rate of 12%. All the other indicators are positive with the best performance occurring when the project cost is reduced by 15%. The worst performance occurs when the project costs increase by 15%. This NG project is therefore a viable entity.

WIND TURBINE PROJECT (SENE-GAMBIA)	SUMMARY OF FINANCIAL RESULTS (BASE CASE AND SENSITIVITY ANALYSIS)							
	KEY FINANCIAL PARAMETERS				**KEY FINANCIAL INDICATORS**			
Variable	**Project Cost**	**Completion Period**	**Repayment Period**	**Discount Rate**	**Return on ANFA**	**Current Ratio**	**DSCR**	**NPV**
	(US$ m)	**(yrs)**	**(yrs)**	**(%)**	**%**			**(US$ m)**
Base Case	318.0	2	10	10%	4.3%	(0.70)	0.34	2.99
+10% Cost Overrun	349.8	2	10	10%	3.3%	(1.25)	0.26	(5.27)
+15% Cost Overrun	365.7	2	10	10%	2.9%	(1.49)	0.23	(9.40)
-10% Cost Underrun	286.2	2	10	10%	5.6%	(0.03)	0.44	11.26
-15% Cost Underrun	270.3	2	10	10%	6.3%	0.37	0.50	15.39
+1 yr Delay	333.9	3	10	10%	3.8%	(0.99)	0.30	(1.14)
+2 yr Delay	349.8	4	10	10%	3.3%	(1.25)	0.26	(5.27)
8% Discount Rate	318.0	2	10	8%	4.3%	(0.70)	0.34	5.83
12% Discount Rate	318.0	2	10	12%	4.3%	(0.70)	0.34	1.25

Table 3.24: Summary of Financial Results and Sensitivity Analysis of Wind Turbine Project (Senegal/Gambia)

The Wind Turbine project records a marginal positive NPV of US$3 Million at the base discount rate of 10%, The NPV is also sensitive to the discount rate as the NPV increases to only US$6 Million at a discount rate of 8% and decreases to US$1 million at a discount rate of 12%. All the other indicators are marginal and for the current ratios negative with the best performance occurring when the project cost is reduced by 15%. The worst performance occurs when the project costs increase by 15%. This Renewable project demonstrates a marginal viability.

SOLAR PV PROJECT (MALI)	SUMMARY OF FINANCIAL RESULTS (BASE CASE AND SENSITIVITY ANALYSIS)							
	KEY FINANCIAL PARAMETERS				**KEY FINANCIAL INDICATORS**			
Variable	**Project Cost**	**Completion Period**	**Repayment Period**	**Discount Rate**	**Return on ANFA**	**Current Ratio**	**DSCR**	**NPV**
	(US$ m)	**(yrs)**	**(yrs)**	**(%)**	**%**			**(US$ m)**
Base Case	549.0	1	10	10%	4.7%	(0.46)	0.40	11.5
+10% Cost Overrun	603.9	1	10	10%	3.7%	(1.03)	0.31	(3.32)
+15% Cost Overrun	631.4	1	10	10%	3.3%	(1.28)	0.28	(10.70)
-10% Cost Underrun	494.1	1	10	10%	5.8%	0.24	0.50	26.24
-15% Cost Underrun	466.7	1	10	10%	6.5%	0.65	0.56	33.62
+1 yr Delay	576.5	2	10	10%	4.2%	(0.76)	0.36	4.07
+2 yr Delay	603.9	5	10	10%	3.7%	(1.03)	0.31	(3.32)
8% Discount Rate	549.0	1	10	8%	4.7%	(0.46)	0.40	18.30
12% Discount Rate	549.0	3	10	12%	4.7%	(0.46)	0.40	7.02

Table 3.25: Summary of Financial Results and Sensitivity Analysis of Solar PV Project (Mali)

The Solar PV project also records a marginal positive NPV of US$12 Million at the base discount rate of 10%, The NPV is also sensitive to the discount rate as the NPV increases to US$18 Million at a discount rate of 8% and decreases to US$7 million at a discount rate of 12%. All the other indicators are marginal and for the current ratios negative, with the best performance occurring when the project cost is reduced by 15%. The worst performance occurs when the project costs increase by 15%. This Renewable project demonstrates a marginal viability and needs to be supported by subsidies (for instance de Clean Development Mechanism of the Kyoto protocol).

The fact that the generation and interconnection program as a whole is viable but some of its sub-programs are not viable is not surprising. The optimization was done for the program as a whole and not derived from a collection of viable sub-programs. This means that, attempts to justify individual segments of the program for purposes of implementation could be misleading. Justification of the financial viability of segments of the program for purposes of implementation should therefore be based on the fact that they form an integral part of a viable optimized. Each sub-program should therefore be treated as a phase of the overall interconnection program rather than a standalone project.

3.7. Impact of the program on tariffs

3.7.1. Bulk generation tariffs

Utility tariffs in almost all the utilities analyzed appear not to be adequate to cover the full costs of operations. The table below compares the prevailing tariffs in the ECOWAS region with those of other regions in Africa. It shows that tariffs are much higher in the ECOWAS region than all other regions on the continent.

COMPARATIVE AVERAGE ELECTRICITY TARIFFS (CENTS US$/KWH)

SUB-REGION		WEST	SOUTHERN	EASTERN	CENTRAL	AVERAGE	%
Social Tariff (E=100 kWh/month)	1 kW	13.07	5.09	9.55	8.13	8.96	146%
Monophase domestic usage	2 kW	14.95	7.84	11.59	9.85	11.06	135%
(E = 200 kWh/month)	4 kW	15.61	8.07	11.59	10.55	11.45	136%
Three phases Domestic usage	6 kW	16.44	7.72	12.99	11.06	12.05	136%
(E = 600 kWh/month)	10 kW	16.84	8.53	12.99	11.36	12.43	135%
Three phases commercial usage	12 kW	19.31	8.62	14.05	12.31	13.57	142%
(E = 1.800 kWh/month)	15 kW	19.54	8.97	14.12	12.52	13.79	142%
Mid-industry & motive power	20 kW	18.69	8.72	12.35	11.85	12.90	145%
(E = 2.500 kWh/month)	25 kW	18.84	9.53	12.53	12.10	13.25	142%
Medium voltage	250 kW	17.58	7.95	9.72	10.08	11.33	155%
(E = 35.000 kWh/month)							

Table 3.26: Comparative Average Electricity Tariffs in Africa
Source: "Comparative study of electricity tariffs used in Africa-December 2009", conducted by the General Secretariat of UPDEA

In spite of their much lower tariffs, the summary of their financial performance below shows that ESKOM and KENGEN performed far better than the ECOWAS utilities.

SUMMARY OF FINANCIAL RATIOS - ESKOM

	2010	2009	2008	2007
Return on Average Net Fixed Assets (%)	1.63	(5.29)	(0.11)	4.77
Current ratio	0.91	0.78	0.85	0.67
Debt Service Cover Ratio	2.53	0.75	0.68	11.43
Days Receivables (for Distribution)	22	20.8	19.5	19.5
Average debtor days for Transmission	16.1	18.1	16.5	–

Table 3.27: Financial Performance of Eskom - RSA

SUMMARY OF FINANCIAL RATIOS - KEGENCO

	2010	2009	2008	2007
Return on Average Net Fixed Assets (%)	2.36	4.92	3.35	7.00
Current ratio	4.68	2.17	1.40	2.00
Debt Service Cover Ratio	4.50	3.90	4.99	5.40

Table 3.28: Financial Performance of Kegenco - KENYA

This situation underscores the need to look to cost reduction instead of tariff increases to solve the viability problems faced by ECOWAS utilities.

Furthermore, most ECOWAS countries fall within the low to low middle income level categories. Affordability and unwillingness to pay (on a few occasions civil protests have followed tariff increases) are therefore major consideration of Government's in rate setting. Unfortunately ECOWAS countries face high cost of electricity because of the sub-optimal technology employed in power generation in the region. Regional projects that are capable of generating electricity at lower costs due to the economies of scale associated with their large sizes and/or the fact that these projects are located in countries better endowed with cheaper generation resources should therefore be encouraged and supported by Governments, as a means of reducing the upward pressure on tariffs.

The optimized WAPP priority program has proved to be a more efficient way of dealing with the energy crises in the region. The program will result in an estimated average energy cost of $0.0821/kWh and postage stamp Transmission Service Charge of $0.0169/kWh in the long run. This amounts to a Bulk Supply Tariff (BST) of about US$0.0995, at a crude oil price of US$100 per barrel. The BST reduces to US$0.0904 at a crude oil price of US$75 per barrel and increases to US$0.1085 at a crude oil price of US$125 per barrel. This should form a basis for determining an efficient tariff for supply in the region in medium to long term.

What needs to be done is the determination of equitable tariffs for power exchanges between countries and the management of the high costs of energy supply till the regional program is fully implemented.

Two issues need to guide rate setting for power exchange during the transition period. These are;

- Full cost recovery by the exporting country, and
- Sharing of the savings accruing to one country by importing from another country.

Full Cost Recovery by the exporting country

It is unusual to expect one country to generate electricity for supply to another country at a loss. Governments and civil society will not support such an arrangement. A country is therefore more likely to produce electricity for export when it is assured of full cost recovery, including a reasonable rate of return. This situation should be applied where the generation for export requires the construction of a new plant and the computed export tariff is lower than the internal cost of generation of the importing country.

Equal sharing of the savings accruing from then exchanges

This situation will be appropriate in a situation where the exporting country has excess generation capacity and either

- The variable cost of the exporting country is lower than the variable cost of internal generation of the importing country, or
- The total cost of the importer building a new facility will be higher than the running cost of the exporters' plant.

In these situations the exporter will accept a tariff which is lower than its full cost recovery level but higher than its running cost.

3.7.2. Transmission service charges

The postage stamp model transmission service charge estimated as US$ 0.0168/kWh has been used in the evaluation above. The approach does not take into account the different distance over which the energy is transported to the recipient and the associated losses. This could be unfair to importers that are close to the source of their imports, say from a WAPP regional plant in Ghana to Ghana or Togo as against exports from such a plant to Mali. We recognize that the intention is spread the burden of transmission services evenly over countries in the spirit of regional cooperation. This should not however be done to the detriment of some of the countries or without taking into account peculiar/specific costs imposed by each country on the system. This includes especially losses associated with transmission of energy over long distances to particular countries.

The other alternatives for transmission services pricing are:

- Megawatt-Mile Pricing, and
- Zonal Pricing

Megawatt-Mile Pricing

The Megawatt-Mile Pricing takes into account both the amount of power and the distance over which it was transmitted in the computation of the transmission service charge.

The total costs would be the same as those under the postage stamp, i.e., project investment cost, the operating, maintenance, management and administration costs and the cost of transmission losses. The revenue would however be based on the product of the capacity on the transmission line in megawatts reserved or allocated for particular users, the distance over which the power is transported and the TSC. Since this unit tariff would also be uniformed and constant, it would be determined as the present value of costs of the project divided by the present value of the annual MW-km over the project life.

Even though the megawatt-mile unit price makes it represents an average tariff for the entire project each user pays according to the capacity and distance over which the power is transported. The megawatt-mile pricing structure is not as simple as the postage stamp as it requires precise monitoring of the source and destination of the energy transported. This could be quite difficult in a power pool situation where energy exchanges may not be exclusively by bi-lateral arrangements and therefore it could be difficult to trace the origin of the energy delivered.

Zonal Pricing

The Zonal Pricing lies between the other two alternative approaches. Under this approach, separate postage stamp charges are computed for the transmission of energy between the designated ‘zones’. Each country could for example constitute a zone. The applicable tariff would be determined as the values which equated the discounted costs within the zones over the project life to the discounted revenues from transfers between those particular zones.

3.8. Some risks associated with the WAPP Program

Timing of Takoradi and Maria Gleta Plants

Two critical requirements usually demanded by lenders for financing of thermal plants are;

- a bankable Power Purchase Agreement, and
- a cost effective fuel supply arrangement.

The poor financial condition of most of the utilities is responsible for this requirement from prospective lenders. Lenders will want to see a credible off-taker for the power with acceptable payment security to ensure that the producer is paid on time to enable the producer in turn service the debt on time. The WAPP demand for electricity is an aggregated demand from various countries. Securing multiple PPAs for the small demands of these individual countries/utilities which are facing various levels of financial challenges could take considerable time. This could delay the mobilization of funding and therefore execution of the project.

The process for concluding PPAs could be considerably shortened if WAPP had an aggregator who would gather the small demands of individual countries into a large bulk demand and negotiate the purchase of energy for supply to these countries. The role of the National Bulk Energy Trader in Nigeria is an example of this sort of arrangement.

Lenders are equally concerned about availability of affordable fuel to ensure that the financial burden imposed on the seller and therefore the upward pressure on tariffs is reduced. The consultant is not aware of any confirmation of availability of gas for the two plants. The non-availability of gas, the planned fuel for running these plants could be a major source of delay for project implementation.

Concentration of hydro-electric generation in Guinea

The situation where so many countries will depend on Guinea for the supply of their electricity could be risky. Any event such as political turmoil, drought and delays in the realization of these projects, or positive changes in Guinea's industrial development which requires significant increases in energy consumption, especially in the mining sector could have adverse impact on the dependant countries in terms of either high costs of alternative generation sources or un-served energy

National Energy Security Policy and import levels

It may not be prudent for countries to depend on other countries for the supply large proportions of their electricity requirements. Countries will normally want to have control over a certain minimum amount of generation required for essential services such as hospitals, security installations, etc.

Tariff approvals and viability of utilities

The analyses of the past performance of the utilities showed that they all have financial challenges. These are mainly because of inadequate tariffs and poor bill collection rate. Bill collection rate target is usually one of the performance indicators used by utility regulators to judge the performance of the utility for purposes of tariff increases. Considering the fact that tariffs are already high in the ECOWAS region, it is futile to continue to expect any significant increases in tariffs for utilities that are not able to collect the sales proceeds accruing from the tariff increase, especially in an environment where the ability and willingness to pay are low. The situation poses a major risk to the utilities' viability, which could have an adverse effect on efforts to mobilize capital for execution of the projects.

3.9. Conclusion and recommendations

3.9.1. Conclusions

1) The optimized WAPP Priority Program is a viable program as provides because it provides higher financial benefits to both Zone A and Zone B blocks. It therefore provides a more cost effective solution to the energy crises in the region than the programs lined up by the individual countries.

2) Even though the program is made up of distinct sub-programs, not all the individual sub-programs are necessary viable on stand-alone basis.

3) The renewable energy project SPCs are also no viable using the long term system average tariff computed using the optimized regional generation and transmission plan.

4) All the utilities whose financial data were analyzed face financial challenges due to large accounts receivables and the fact that the tariffs appear inadequate to cover operating costs in full. A comparison of the prevailing categories of tariffs in the ECOWAS region with average tariffs corresponding categories on the continent however shows that tariffs in the ECOWAS region are between 135% and 155% higher than the average on the continent..

5) The following are other events which could pose various levels of risk to the successful implementation of the program

- Timing of Takoradi and Maria Gleta Plan
- Concentration of hydros in Guinea.
- National Energy Security Policy and import levels

3.9.2. Recommendations

- The prevailing tariffs in most WAPP countries are higher than the average long term tariff of about US$0.10 computed using the optimized WAPP program. The prevailing tariffs are also much higher than their counter-parts on the African continent. Cost reduction initiatives in areas such as loss reduction, efficiency in bill collection and energy use, increased private sector participation in the energy supply chain as well as more cost effective generation technology should be pursued as a means of improving the viability of WAPP utilities, instead of tariff increases. Each member state should propose a clear and concrete action plan to improve their performances. This action plan should be closely followed and audited by WAPP.
- Special concessionary funds and financing instruments such as Carbon Credits should be pursued for financing of renewable energy to make them viable.
- Other pricing options of the transmission service charge, such as Zonal Pricing and Mega-Watt Mile should be explored to take account of distinctive/peculiar costs imposed by individual countries on the transmission of energy, such as losses associated with transmission over long distances at the time of detailed negotiations for the implementation of the projects.

4. WAPP PROJECT IMPLEMENTATION STRATEGY

4.1. Background

Most of the member states of the Economic Community of West African States (ECOWAS) have deficits in electrical energy supply and low penetration rates of electricity distribution. This is against the background of availability of diverse and abundant energy resources such as hydro (Ghana, Mali, Guinea and Nigeria), oil and gas (Nigeria, La Cote d'Ivoire and Ghana) which remain largely under-utilized for power generation. Apart from the fact that these energy resources are not evenly distributed in the region, countries located along the coast have comparatively lower costs of generation due to lower transportation costs of liquid fuels that are used in power generation compared to landlocked countries which have to truck such fuels over long distances at additional high costs to their countries.

The ECOWAS Member States have acknowledged that efforts by countries acting as individuals to achieve national self-sufficiency in energy over the years have been slow and uneconomic, resulting in inefficiencies, high cost of power generation and transmission and existing capacity shortages. They agreed that an integrated regional approach to the exploitation of the diverse energy resources could provide a solution to the regional energy problems.

Accordingly in 1999 the ECOWAS Member States committed themselves to set up a regional electricity market, the West African Power Pool (WAPP). This is a framework under which the electric utilities from member countries to collaborate to promote regional investments in the development of generation and transmission facilities. The West African Power Pool (WAPP) was accordingly set up by decision A /DEC.5/12/99 of the ECOWAS Heads of States and Government in 1999 as specialized legal institution of ECOWAS. Its mandate is to facilitate collaboration among member utilities to establish a unified and competitive regional electricity market in West Africa through attracting investments for development of the diverse and abundant energy resources in the region for their collective economic benefit and integration of the operations of the various national power systems of ECOWAS Member States.

The WAPP Convention institutes the management structures, defines their organization and procedures in order to establish a good co-operative mechanism between its Members. The organs of governance and decision making in WAPP include:

- the General Assembly as the highest decision making body, comprising representatives from the member states which has the authority for determining the strategic policy direction of the organization
- the Executive Board takes into account the policy directions of the General Assembly to develop and implement initiatives to achieve WAPP's mission
- Committee of Experts in Engineering and Operations, Strategic Planning, Finances and Human Resources
- WAPP General Secretariat is the administrative organ that supports the Executive Board in the accomplishment of its initiatives.
- WAPP Information and Coordination Center.

The power pool is not functional at the moment because there are only limited interconnections among the electrical systems of WAPP member countries. Also the individual member countries with significant generation resource endowments have not been able to develop sufficient generation capacity to create surplus for export to less the endowed countries in manner that a power pool operates.

In order to create the basic infrastructure required by the power pool to function effectively, the WAPP Organization mandated its Secretariat to facilitate and coordinate the implementation of specific priority regional generation and transmission projects that are necessary to integrate the electrical systems of member states, improve the availability of energy supply and establish the regional power market. This is an innovation that is not common with power pools.

Accordingly, the WAPP Secretariat coordinated the preparation and approval of a Master Plan comprising priority generation and transmission projects that are needed to accelerate the integration of the transmission systems of member countries and to provide adequate energy at lower costs than those being built by individual countries. This plan which was approved and adopted in 2005 includes the following projects:

1) Reinforcement and upgrade of the existing transmission line interconnection between La Cote d'Ivoire – Ghana – Togo – Benin – Nigeria – Niger.
2) Strengthening of the transmission network from the power generation hub in Takoradi to Han within Ghana and extend it to Burkina Faso and Mali to facilitate the transfer of relatively cheaper power produced in Ghana to Burkina Faso and Mali, which face very high cost of energy generation due to the high cost of transporting fuel from the coast to these land-locked countries.
3) A north core transmission line development covering Benin – Nigeria – Niger
4) Development of the Gambia – Guinea – Guinea Bissau – Senegal interconnection, and
5) The La Cote d'Ivoire – Liberia – Sierra Leone – Guinea interconnection line.
6) Generation projects such as:

- Reconstruction of Mt Coffee and development of St Paul hydropower plants in Liberia.
- Expansion of Bumbuna hydropower station in Sierra Leone.
- Maria Gleta Thermal Plant in Benin.
- Aboadze Thermal Plant in Ghana.
- A thermal plant in the OMVS region.

Some six years after launching the program, even though some progress has been made in the implementation of the program, significant delays have been observed in the development of other projects. Gaps have also been identified between the objectives and components of the approved regional master plan and the power systems development initiatives being pursued by individual WAPP member countries. There is therefore an urgent need to accelerate the implementation of the priority projects and to harmonize and coordinate initiatives among WAPP member countries to ensure the effective development of power systems at both the regional level and within WAPP Members States.

The section of the report uses the lessons learnt from implementation of the 2004 Master Plan and other relevant international precedents to design a strategy that will accelerate the implementation of the updated version of the Master Plan.

4.2. Review of the status pf the 2004 priority projects

A detailed review of the development of the Coastal Backbone Project, Cote d'Ivoire Burkina Faso Line, the Takoradi and Maria Gleta Thermal Power plant projects as well as a comparison of the status report of the priority projects in WAPP's 2009 – 2012 Business Plan with their status in the report presented at the donors meeting in May 2011. This has revealed the following issues as the causes of the delays in the implementation of almost all the 2004 priority projects.

1) In ability to match of commissioning transmission projects with of adequate generation
2) Limited ability of the General Assembly and Executive Board to enforce WAPP decisions which require action from other sectors of their countries' economies
3) The approach adopted for implementation of cross border transmission projects
4) Non availability of gas in sufficient quantities for power generation in the region.
5) The poor financial state of the utilities due high operating costs, distribution losses and low bill collection, which are obstacles to mobilization of funding.
6) Inadequate human and financial resources to meet the requirements of the WAPP Organization in project conception, development and implementation.

4.2.1. Inability to match the commissioning of generation and transmission projects

The main objective for implementation of the Coastal Backbone Project is to enhance power trading between the five coastal States of Nigeria, Benin, Togo, Ghana and Cote d'Ivoire. Substantial progress has been made in the implementation of this transmission project, which coupled with existing transmission lines between Ghana Togo and Benin can support significant energy exchanges between these countries. The interconnection between Cote d'Ivoire and Burkina Faso is another situation where cross border transmission facilities have been developed without matching improvement in generation. Energy shortages therefore continue to persist in all these countries even though they are interconnected, because of lack of matching generation. The generation facilities required to produce the energy for trading among these interconnected countries includes principally the thermal plants at Takoradi in Ghana and Maria Gleta in Benin. Unfortunately no significant progress has been made in the development of these matching generation plants. Successful operation of these existing interconnections can inspire other countries to commit towards the interconnection of their systems. There is therefore the need to match the commissioning of interconnection transmission projects with generation to ensure that the full benefits of the interconnection are achieved.

In fact, the presence of significant trading between the existing interconnected countries could provide the real time situation for ERERA to establish the required regulatory framework for the region.

4.2.2. Limited ability of the General Assembly and Executive Board to enforce WAPP decisions which require action from other sectors of their countries' economies.

Members of General Assembly and Executive Board are mainly executives in the power sectors of their countries. Their influence or powers to issue directives to other departments on actions that are required to be taken in order to facilitate the implementation of the priority projects could be limited. As executives in the power sector, they may also not have up to date information on developments in other sectors which could affect the operations of WAPP. This composition of the General Assembly and Board are more suitable for a functional power pool. The issue of Ghana providing land for the construction of the thermal plant at Takoradi is a typical example. As a regional export oriented plant, the facility qualifies for a free zones status and should be able to acquire land in the free zone enclave at Takoradi. Availability of gas from Nigeria for the Maria Gleta plant is another issue which could have been identified at the conception stage of the project if the decision making entity comprised representatives with multi-sectoral knowledge and influence. There is therefore the need to establish a Steering committee/Oversight committee/Project Implementation Unit with the ability to deal with cross-sectoral issues for each project, as is being done for the CLSG Interconnector.

4.2.3. The Old Project Implementation Approach

The 2004 WAPP Master Plan consists of several distinct but mutually reinforcing sub-programs that fully inter-connect the electrical systems of all the member states of ECOWAS. The project implementation approach adopted for execution of the priority projects places the ultimate responsibilities for funding and physical implementation of the respective segments of these projects upon the main power utilities of WAPP member countries over whose territories such particular segments of the project traversed. Unfortunately, the execution of these projects using this approach, to date, has been faced with significant delays.

Weaknesses in the Approach

The project implementation approach adopted has turned out to be ineffective due mainly to the following major factors:

- Non-convergence of national energy supply programs with the WAPP priority Projects.

Availability of secured, adequate and affordable energy is necessary for the socio-economic development of every country. Governments therefore strive to procure energy supply, at times at very high costs, for the development of their countries. Sub-regional organizations like WAEMU (UEMOA) are also far advanced developing strategies, including sourcing for financing, to deal with their energy supply problems as a group. In order for a WAPP member or group to have the requisite incentive to commit to the implementation of the WAPP project, the solution to national energy needs of such a member country must converge with or be complemented by the objective, implementation schedule and cost of the relevant WAPP project under the responsibility of such member country. The national priority programs and WAPP priority programs have not converged in the period after the adoption of the WAPP Master Plan and therefore the WAPP programs have not received the commitment and resources required from the various states for their implementation.

For example, the CEB (Togo/Benin) have held up implementation of the Tema (Ghana) Mome-Hagou portion of the 330KV Coastal Transmission Line Backbone project because it appears not to have converged with the national energy projects priorities of the Togo and Benin. The existing interconnection line from La Cote d'Ivoire through Ghana to Benin has the capacity to transport the amount of energy they required by the two countries. What they need first is dependable sources of supply from the interconnected countries. In the absence of firm contractual supply from these import sources, the countries appears to be more focused on securing other sources of supply instead of expanding the transmission line capacity. This lack of convergence between the WAPP project objectives and the priorities of Togo and Benin has caused a delay in the realization of the WAPP priority project.

The delay in the commencement of the 440MV Maria Gleta Thermal Power Project in Benin is another instance of dislocation between the national energy priorities of a key participant in this project, namely Nigeria as the provider of gas and the relevant generation project conceived under the WAPP priority projects. The conclusion of a Gas Supply Agreement between Nigeria and the entity undertaking the Maria Gleta project is crucial for the commencement of the project. But the crisis of gas supply to local power utilities in Nigeria, due to inadequate gas pipeline infrastructure within Nigeria, has rendered it politically unsuitable for the Nigerian government to conclude a gas supply agreement with the Maria Gleta project and this has stalled the start of the project.

A fundamental lesson to be learnt from the unfortunate events noted above is that, the engagement of the WAPP members in the process of formulation/selection of the WAPP priority projects and the periodic update of these priority projects should be a continuous one. This way the priorities of the countries can always be synchronized with that of WAPP in such a manner that while pursuing the medium to long term objective of regional integration, the short term needs of the participating countries would be catered for. This will provide the incentive for the individual countries to actively support the regional program.

- Challenges in Project Implementation Coordination and Management.

Countries have different capabilities in terms of expertise to manage development projects. They also face different challenges in terms of attracting investments for infrastructure development because of differences in their overall macro-economic and political environment. The two factors have led to different start dates for construction of the various segments which integrate to form a transmission line designed to be completed at a set time to serve an identified need for the participating countries. Moreover, as the human resource capabilities in project development and implementation vary from country to country, the project cannot move faster than the pace determined by the weakest country/utility in the group, leading to delays. The situation has left countries with no alternative than to continue to embark on their own programs to deal with the energy crises, creating a variance between the WAPP program and the individual country programs. The initiatives by the various countries have been expensive and ineffective because the type of technology and equipment that could be procured and installed speedily for power generation are usually small and/or and high cost fuel based thermal generation plants.

- Difficulties in justifying the viability of separate segment of viable regional projects

The financial and economic benefits of program which are critical to the mobilization of funding for project implementation can fully revealed only when the program is assessed as a whole and in a regional context. The fact that the program as a whole is financially viable does not mean that each of the distinct segments would be viable by itself. Attempts to justify separate segment of the program for implementation because it lies within a particular country's geographical boundary have faced difficulties and made it practically difficult to mobilize financing for that segment of the project. Such a problem may not arise if the project were considered as a whole.

It is relevant to mention that there could be other problems created by the existing project implementation approach even after the commissioning the facilities. Key among these are:

- The right of use for national as against regional demands.

Citizens of a country which has developed and financed the construction of a power transmission facility using its national resources will feel entitled to the use of the facility and be accorded the privileged status when there are competing demands for use of the line. This could impede and violate the free and open regional access objective enshrined in the ECOWAS ENERGY PROTOCOL and being pursued by WAPP.

- Pricing of transmission services

Differences in pricing regimes of various countries due to differences in macro-economic conditions of various countries could lead to different charges on different segments of a transmission line conceived to be a common facility.

There is therefore the need for the adoption of a project development and implementation approach that will ensure the full support and cooperation of the participating countries at all stages, including the planning and periodic update of the regional plans. The strategy should also make it possible to use the best expertise and capabilities in the participating countries for use in the implementation of the entire project and ensure that the execution of a viable project is not unduly delayed by futile attempts to justify segments of the project which are not viable by themselves. Finally, it should not create dominant position that would affect the objective of WAPP to create regional facilities with open and equal access to all countries.

4.2.4. Non Availability of gas for power generation in the region

Delays in delivery of sufficient quantities of gas through the West African Gas Pipeline Project and/or the development of Ghana's indigenous gas for generation of affordable electricity in Ghana, Togo and Benin have led to delays in the construction of the planned Maria Gleta and Takoradi thermal plants.

4.2.5. The poor financial state of WAPP utilities

Prevailing utility tariffs in most WAPP countries are high compared to those in other regions on the continent. However, the operating margins of these utilities are still poor. These are due largely to high operating costs resulting from using aged/obsolete generation and distribution equipment, high cost of fuel used for generation, inefficient billing and collection system as well as inefficiencies and interferences associated with public sector management of these systems. Regional integration of the generation and transmission systems will provide more efficient and cost effective generation and transmission facilities, but the full benefits of the regional initiative can only be realized when complemented by efficient distribution systems. Countries like Ghana, Sierra Leone and Liberia have initiated distribution loss reduction, efficiency improvements in energy use, pre-paid metering and incentive based bill collection systems. Ghana's Public Utilities Regulatory Commission has also set targets for loss reduction and bill collection as a necessary condition to be met and input for rate determination. Nigeria has commenced the process to introduce private sector participation in distribution. All these initiatives are required and must continue to be pursued by WAPP utilities and supported by the WAPP Organization to achieve the full benefits of the availability of cheap power through regional integration.

4.2.6. Inadequate human and financial resources to support WAPP activities

The WAPP organization requires adequate and regular funding to use its unique status as a specialized legal ECOWAS institution to drive the region's development agenda. It can also create a pool of experts in project conception, development and implementation monitoring to support the various member utilities. The Articles of Association of WAPP require all members to contribute to the full costs associated with the performance of the functions of WAPP as assessed monthly and charged by the WAPP Executive Board to WAPP members in accordance with a stipulated formula. This has not materialized as contributions from member states and ECOWAS are often inadequate and irregular. Lack of adequate finance has made it impossible for the secretariat to:

- Procure the full complement of permanent professional staff required to carry out the project implementation coordination function assigned to them. In the absence of the full complement of permanent experts, the secretariat has had to rely on seconded staff from the utilities to perform the roles of the experts. The motivation, tenure and control of seconded staff can restrict the capability of the secretariat to perform their role under the project implementation effectively. The fact that the tenure of such temporary employees may not necessarily coincide with the amount of time required to develop and implement specific projects has often led to the change of hands mid-stream, which is another cause of the delay in the project implementation. The frequent changes in staff would also deprive the secretariat of developing the in-house expertise and improvements in performance efficiency usually associated with permanent staff. It is also possible that the seconded staff may not be motivated to give their best on their assignments with WAPP. This is because they look up to their mother utilities for their compensation, which is not directly tied to their performance at WAPP.

- Procure the services of consultants on timely basis to carry out critical project development activities. The secretariat is able to hire consultants only when it secures funding, usually from the international donor community. This procurement of such external funding dictates the schedule for execution of critical assignments, instead of deadlines determined by the in-service date of the facility.

4.3. The approved new implementation strategy

4.3.1. Background

Successful and accelerated implementation of the WAPP priority projects requires a structure that will avoid or at least mitigate the causes the delays outlined above. It should be capable of ensuring the full and un-alloyed endorsement of and acceptance by the member countries and all relevant parties of the priority projects. Equally crucial, would be a well defined and set-up institutional framework/structure in which participants have a common/convergent mission, well defined roles/functions, rules, and procedures to ensure efficient implementation of the project. This must be backed by adequate human, technical, financial and other material resources as well as effective organization for the management of each of the stages of the project.

Faced with delays in implementation of the 2004 Priority Projects and the resultant prolonged and widespread energy deficits in the region, the WAPP Secretariat had to commission the Emergency Power Supply Security Plan Study in 2006 to find a solution the situation which was adversely affecting the socio-economic development of the region. The study recommended specific actions to be taken in respect of the development of generation and transmission facilities needed to mitigate the persistent energy crises and meet the aspirations of WAPP. It also made suggestions for improvements in the areas of human resource capacity building, tariffs, financial management and power system losses. The results of the study as well as other proposals aimed at accelerating the implementation of WAPP priority projects were discussed at the 33rd Summit of the Heads of States and Governments of ECOWAS held in Ouagadougou in January 2008, and Supplementary Acts A/SA.3/01/08 and A/SA.4/01/08 adopting The West African Power Pool Transmission Line Implementation Strategy and Emergency Power Supply Security Plan Study recommendations, respectively, were signed and adopted.

Both Acts adopted the use of the Specific Purpose Company (SPC) model in the form of public/private partnerships to expand the financing options available to WAPP in order to facilitate the implementation of the priority regional power projects.

4.3.2. The Specific Purpose Company (SPC) and its advantages

The Specific Purpose Company is usually an organization or institution comprising experts in various fields such as project financing, works procurement and project implementation, operations and maintenance. As members of the same institution they are bound to work towards the same mission and objectives, such as efficient and accelerated implementation of a WAPP priority project. They should also be more effective in project coordination and management and to ensure timely completion of the project. The SPC approach can therefore eliminate the two major weaknesses cited above as related to the existing project implementation approach, namely, the lack of convergence of priorities of the participating countries and the poor project coordinated and project management**.** The SPC could be in the form of a joint venture, a company, an IPP or any hybrid of these vehicles, depending on the nature of the project and the capabilities of the participants.

4.3.2.1. ESTABLISHING THE SPECIFIC PURPOSE COMPANY

Relevant Precedents

The process of establishing the under-mentioned SPCs, their structure and the roles of the participating countries are models which offer very practical options that can serve as a useful guide in the structuring of the WAPP SPC.

These SPCs are:

- the WAPCo model under the WAGP Project,
- the SIEPAC model in Central America,
- The Gulf Cooperation Council Interconnection Authority

The WAGP Project/WAPCo

The WAPCo sub-regional SPC model is of direct relevance and interest to our exercise because it's within the same sub-region, involves some of the WAPP member countries, is current and live, concerns an interconnected energy infrastructure and will provide a critical input (natural gas) for the operation of some of the WAPP projects

The first step to form the SPC was the execution of a "Heads of Agreement" to select a private developer to build, own and operate a pipeline for open access transportation of Natural Gas from Nigeria and any other sources along the route of the pipeline to consumers in Benin, Togo and Ghana.

A Steering Committee was formed under the Heads of Government which mandated its representatives to negotiate the International Project Agreement (IPA).

The IPA gives exclusive rights to the SPC to develop the pipeline by enjoining the States not to enter into negotiations with, or issue any consents, permits, licenses, approvals or similar authorizations to, any other person in relation to the establishment of a cross-border pipeline or pipelines for the transmission of Natural Gas where the delivery of Natural Gas from such a pipeline would be capable of competing with the delivery of Natural Gas shipped through the Pipeline System. Risk managing/allocation issues are of major concern to the investor; the arrangement therefore assured the investors that their potential business earnings from building and operating the pipeline would not be derailed mid-way through the construction of the project by an unanticipated interloper investor.

The IPA also provided a guaranteed initial 20 year period of operation by WAPCo, which could be extended for as long as a Pipeline License remains in force provided the SPC was not in material breach of its obligations under the Pipeline Licenses.

It further covers in how:

- the governments will work together with the SPC to implement the project
- the SPC will be registered in each country as a foreign company (and exemptions are granted for so long as the SPC holds a pipeline license)
- restrictions on the reorganization of the legal corporate structure
- Accounting principles and denomination of accounts.
- Restriction on share transfers
- The way in which an eligible entity can be nominated as the single local investment entity for each state (ensuring that local citizens can benefit) and the ways in which it can acquire up to 25% of the shares (or debt owed to shareholders) of the SPC (either by transfer or the allotment of new shares) including the pricing by way of a valuation of the Securities to be acquired.

An Inter-Governmental Agreement (IGA) under which the states agreed to establish a harmonized investment regime for the Project and to establish the enabling environment necessary for the Project to be successful was also executed. The creation of an enabling environment was not just to ensure competence and efficiency in project implementation, but also to give potential investors the right climate and protection for their investment.

The States then entered into the West African Gas Pipeline Treaty (the ***WAGP Treaty***) by which they agreed to implement and respect the terms of this IPA, to establish the WAGP Authority as a regulator, the WAGP Tribunal and the Fiscal Review Board, and to foster a stable and harmonized legal environment in which the Project will operate. The Treaty committed the States to the project in its objectives, place in the priority order of projects and funding required.

SIEPAC – Central America

(This summary has sourced the information on the SIEPAC mainly from World Bank Study on Institutional Development of the West African Power Pool prepared by Ms. Fiona Wolfe, an International Consultant as well as other World Bank sources)

Sistema de Interconexion Electric de los Paises de America Central (SIEPAC) was formed as a regional electricity market after some 8 years of negotiations which resulted in the signing of a Treaty that was fully ratified giving it the force of law in each country.

The following institutions were established

- Regional Regulator (CRIE) consisting of one commissioner drawn from each of the national regulators. Its roles included approving all the technical and market rules and enforcing the legal and regulatory framework.
- Regional System Operator (EOR) also acting as the market administrator drawn from each of the six countries.
- Regional Transmission Owner (EPR) that owns the new line and associated transmission assets necessary to support regional power trade (created under a Treaty)
- Market agents (participants) including national utilities and IPPs
- Designated national system operators through which the coordination of the pre-dispatch, real time dispatch and post-dispatch settlements and information exchange would be carried out by the Regional System Operator.

The project management and strategic direction involved:

- A High Level Governmental Steering Committee
- A small Secretariat that hired and managed consultants and facilitated discussions between and within all governments and stakeholders with very considerable expertise to identify and solve problems on a daily basis.
- An external three person Expert that reviewed all the work and decisions and made recommendations (that were usually followed) and gave advice when difficulties were encountered.

The SIEPAC approach was effective in the following ways:

National and regional institutions were involved in the design of the technical and market rules and were therefore committed to their implementation

The Governments had high level representation at the project oversight panel which enabled them to follow progress and which enabled them to intervene to solve problems without being seen as interfering or undermining the authority of the regional institutions.

The six countries adopted the Treaty, the protocols, the rules and the decisions of the Regional Regulator and enforced them directly through their own legal systems.

There was clear definition of roles, responsibilities and accountability of all the institutions.

The market design allows for firm and non-firm bilateral contracts and a spot market for opportunity trading. It also allows for regulated third party access to transmission systems at regional and national transmission systems, and for third parties to build transmission on a merchant and/or regulated basis.

The Gulf Cooperation Council Interconnection Authority

The Interconnection Authority that project that was established in 2001 by a Royal Decree. It is owned by six countries, namely, United Arab Emirates (15.4%), Kingdom of Bahrain (9%), Kingdom of Saudi Arabia (31.6%), Sultanate of Oman (5.6%), State of Qatar (11.7%) and State of Kuwait (26.7%). The Authority is managed by a twelve (12) member Board of Directors, represented by two (2) members from each country. The chairmanship is rotated among the member states every three years.

By 2009, the first phase of the interconnection project estimated at US$1.095 Billion, was completed for the economic benefit of the participating countries. This consists of;

- Some 422km of 400-kV overhead transmission lines connecting Bahrain, Saudi Arabia, Quarter and Kuwait
- 400-kV substations
- Underground submarine cables
- HVDC converter station
- Protection, control and optic-fiber-based telecommunication infrastructure

The WAPCo , SIEPAC and GCC Interconnector Authority structures and processes provide testimony as to how the involvement of Government representatives at high level points of decision making can facilitate the use of decrees, protocols, treaties IPAs, national legislation to establish and create conducive and enabling environment for the development of generation and transmission infrastructure. The current organization structure of WAPP does not involve representatives of the participating Governments to facilitate the enforcement of decisions taken by the Heads of States. The involvement of such high Government officials is necessary to resolve multi-sectoral issues that will facilitate the implementation of projects.

4.4. WAPP Power Framework that would influence/guide the establishment of SPCs

4.4.1. Legal Framework

The ECOWAS Treaty and Energy Protocol

Various sections of the ECOWAS TREATY, especially articles 3, 26, 28 and 55 outline the basic principles for promotion, cooperation, integration and development of the energy sectors of the ECOWAS Member States.

The ECOWAS Executive Secretariat has followed this up with the enactment of the Energy Protocol which aims at developing a legal framework for promoting long term cooperation between the ECOWAS Member States in the Energy field. The protocol provides for cooperation among member states to increase investment in the energy sector and develop energy trading in the West African region in order to ensure the security, adequacy and reliability of energy supply. Specific provisions made in the Protocol seek to:

- Ensure free trade of energy, equipments and products related to energy between Member States ;
- Define non-discriminatory rules for trade and dispute resolution;
- Attract and protect private investments ;
- Ensure the protection of environment and development of energy efficiency.

Furthermore, the Member States committed to ensuring open and non-discriminatory assess to sources of generation and transmission equipments situated on their respective territories, through transparent and non discriminatory granting of authorizations, licenses and other contractual documents needed for utilization of these resources. Member States have also committed themselves under the Protocol to facilitate the wheeling of energy on their respective territories under at least the same or even more favorable than their own products and to collaborate to establish new wheeling capacities.

Finally, the Protocol provides for the option of arbitration if an amicable settlement of a dispute between parties under the Protocol or between one of the parties and an investor who cannot be reached. The options are available include:

- National arbitration tribunal;
- Previously agreed arbitration forum/ procedure in the contract, or
- International arbitration and mediation procedures

The International Centre for Settlement of Investment Disputes (ICSID), the arbitration rules of the United Nations Commission for International Trade Law (UNCITRAL), the Arbitration Institute of the Stockholm Chamber of Commerce (AISCC), and the arbitral proceeding of the Organization of Trade Laws in Africa (OHADA) are all recognized institutions under the protocol.

The existence of these protocols will provide the legal framework for operation of the various SPCs.

4.4.2. Regulatory Framework

The ECOWAS Regional Regulatory Authority

The ECOWAS Regional Regulatory Authority (ERERA) has been established as another specialized legal institution of ECOWAS and the regional equivalent of the national utility regulatory commissions. Its mandate is to promote the creation of the enabling environment that will attract investments into the energy sector. This is expected to be achieved through the facilitation of unrestricted cross-border electricity exchange among Member States within a competitive framework, the application of non-discriminatory rules for exchanges and dispute resolution. It also entails the protection and promotion of private investments, and environmental protection and promotion of energy efficiency. Apart from ensuring that the legal framework above is enforced, ERERA will also be responsible for monitoring and enforcement of the harmonization of cross border power trading contracts, technical operating standards, grid codes, methodology and calculation of transmission costs and tariffs, benchmarking of performance and market rules/power pool operations. ERERA will also collaborate with ECOWAS and WAEMU/UEMOA to resolve situations which could give rise to distortions in the electricity market, conflict resolution mechanisms for cross border trading activities. The full complement of organs for ERERA's operation and staff are expected to be in place in the next few months for the regulator to become fully functional.

The presence of the regulator will provide a level playing field for all players in the power pool, including prospective investors. This creates a conducive environment for attracting investments into the power sector.

4.5. Collaboration with the West African Economic and Monatary Union (WAEMU/UEMOA) ans its initiatives

WAEMU aims at harmonizing economic and monetary legislations of its seven (7) member countries. Its influence in the power sector covers the development and control of community legislations concerning competition, implementation of power sector policy and establishment of a common internal market for all member states and setting competition rules of Member States and relevant sector activities.

The founding Treaty of WAEMU defines the following areas of concern to organization:

- Agreements, association and concerted practices between companies with the objectives or resulting in the obstruction or distortion of competition within the Union;
- Any practices by one or several companies, similar to an abuse of a dominant position on the Common Market or in a significant section of it;
- Government aid likely to distort competition by favoring certain companies or certain productions

WAEMU directly intervenes in the power sectors of its member countries through use of its normative instruments to harmonize legislation. It is pursuing a vision to:

- Establish a dedicated funding mechanism for the electricity sector
- Accelerate the emergence of a regional power exchange market
- Develop diversified and competitive energy supply, and
- Develop a regional plan to control consumption of electrical energy.

In order to avoid conflict in the implementation of their respective programs, ECOWAS and WAEMU have signed a partnership agreement for the power sector, covering **t**he West African Power Pool, energy access in rural and semi-urban areas and cross-border oil and gas pipeline projects in West Africa. Other areas covered include the promotion of renewable energy sources, regional energy information systems, improvement of hydrocarbon supply and control of energy. The rest are human and institutional capacity building, sensitization of development partners and resource mobilization for financing energy projects.

WAEMU and ECOWAS also intervene in the power sector legislation through the establishment of a Customs Union and freedom of movement of goods policy within the WAEMU zone and ECOWAS as a whole. This process is still in the transitional phase, as there are still differences in customs policies and internal customs barriers between WAEMU and ECOWAS zones. For example there are no customs duties on electricity importation in UEMOA countries, but import or export of electricity from a UEMOA member country to a non-member country attracts customs duties. This can create tariff differences amongst ECOWAS member states and constitute a major obstacle to the harmonization of power rules and tariffs in ECOWAS member countries. Negotiations are however currently in progress between ECOWAS, WAEMU and the Member States in order to obtain a single tariff regime, a matter that ERERA is planning to address.

WAEMU can therefore be described as an organization which is facilitating the achievement of the same objectives as ECOWAS. What needs to be done is to formalize meetings between the two organizations to ensure mutual reinforcement of their efforts.

4.6. Existing power exchanges contracts

A number power exchange arrangements between countries in the sub-region governed by protocols and Power Sales and Purchase Agreements, even though they are not of the firm and institutionalized nature of the OMVS, exist. This section examines the impact of these existing arrangements on any attempts at re-grouping to form an SPC.

Cote d'Ivoire/Ghana/Togo-Benin/Nigeria/Niger

The power markets between these countries are generally based on short term bi-lateral agreements between utilities of these countries framed under the framework of Government to Government Protocols. These include VRA (Ghana) and CEB (Togo/Benin), PHCN (Nigeria) and CEB, PHCN and NIGELEC (Niger), VRA and CIE (La Cote d'Ivoire) and CIE and CEB with GRIDCo (Ghana) wheeling power from CIE to CEB. Nigeria's power system is currently not even synchronized with those of Togo, Ghana and La Cote d'Ivoire. These arrangements are usually short term in nature, not more than five years duration; renewable periodically and typically based more on goodwill than availability of surplus power for firm contracts.

Usually the parties search for amicable resolution to contract execution, very often through technical committees. Even though there are provisions for the use of the judicial system of one of the countries or arbitration by the International Chamber of Commerce, these are hardly used.

Ghana-Burkina-Faso

VRA and SONABEL have a power supply contract by which VRA supplies 500Kw of power to SONABEL according to the conditions and delivery points stated in the contract in order to feed Po and Leo in Burkina Faso for a period of 20 years. It is renewable automatically in the absence of a no objection by the two operators with the consent of the government of each respective country. Power sales tariffs are revised every three (3) years without clarifying the methods or basis for the revision.

The parties search for amicable resolution to contract execution, the absence of which

Cote d'Ivoire-Burkina Faso

According to a Power Supply Exchange Agreement signed on 6 November 1997 for the duration of 25 years, the Compagnie Ivoirienne d'Electricité will supply SONABEL with a given quantity of power for an agreed price. This, more rigid contract, includes two clauses on institutional changes in Cote d'Ivoire and obliges CIE to supply an agreed quantity of power during the entire contract duration to SONABEL which has agreed to purchase. A tariff revision is to be applied at the end of each fiscal year, especially due to fluctuations of the FCFA or a change in the average marginal cost of energy.

This contract also favors amicable solution to litigation. Failure of which, leads to the litigation being submitted for arbitration by the Common Court of Justice and Arbitration (CCJA).

Generally the provisions in these exchange contracts are similar, with the exception of additional guarantees contained in certain contracts, payment modalities and consequences of delay in bill payment. This basic similarity in the contracts will facilitate the establishment of standards for interconnected power exchanges under WAPP.

4.7. Structure of the power sector of member countries

The power sectors of a number of WAPP member countries are under reform at the moment, but majority of the countries still run a vertically integrated system. Generation, Transmission and distribution are still bundled together. The target structure for countries like Ghana and Nigeria that are pursuing reform initiatives rigorously to:

- have laws that create a competitive energy market involving multiple power generation/distribution participants from the public and/or private sector, and
- an autonomous/independent transmission line entity/ entities with a mandate to operate the transmission line system/grid system on the principle of ‘’open access’’ to all power generators on the basis of ‘’economic merit order dispatch’’/’’least cost’’ order of priority dispatch, governed by a fully functioning market rules and
- have an independent power sector Regulator who approves tariffs and regulates the quality of service..
- WAPP member countries therefore currently belong to one (1) of three (3), categories of energy systems, namely (i) Significantly Unbundled, (ii) Partially Integrated, and (iv) Vertically Integrated

(i) Significantly Unbundled:

This are countries that are at advanced stages of all the key features of the Unbundled system, including the presence of or the enactment of laws that allow multiple generation companies such as Independent Power Producers (IPPs), Public Private Partnerships (PPPs) and State owned generation companies to operate in the market, an Independent Transmission System Operator, implementation of market rules that are fully developed and functioning and the presence of more than one distribution entity. Ghana is far advanced in achieving this status with the establishment of the Ghana grid Company (GridCo) as s separate of transmission utility as well as the separation of distribution into two entities, the Northern Electricity Company (NED) for the northern sector and Electricity Company of Ghana (ECG) for the southern sector. Draft market rules have been prepared and being finalized for implementation and the full functioning of the Public Utilities Regulatory Commission (PURC) as well as the Energy Commission which licenses generation facilities. Nigeria has a fully functional Nigerian Electricity Regulatory Commission (NERC) and has advertised requests for proposals for privatization of generation and distribution facilities as well as an Independent operator for the National transmission system.

(ii) Partially Integrated:

May or may not have an energy sector law or clear and strong government policy that aims at establishing a competitive multi-participant energy market in the medium to indeterminate future: but having a de facto monopoly, (or duopoly such as Niger), strong, direct and dominant role of government institutions/government owned entities in generation transmission and distribution; no independent/autonomous transmission line/grid entity; no independent Regulator/or an ineffective Regulator controlled or heavily influenced by government; no IPP's or IPP's of any significance; no market rules in place or even on the drawing board. Majority of WAPP members fall in this category

(iii) Vertically Integrated:

Characterized by one or two entity monopoly (often government owned), over generation, transmission and distribution of power backed by law or long established government policy and practice; little or no role for other players particularly IPP's; government directly or through government owned/controlled public sector entities regulates power sector and setting of tariffs; no market rules, e.g., Mali, Liberia, Gambia, Guinea Bissau, even though a number of these have a Regulator.

The vertically integrated nature of most WAPP countries means that the sectors should, at least, establish separate accounting records for transmission operations from generation and distribution to facilitate the use of SPCs for transmission line operations. This would make it possible to determine transmission tariffs separately. In the long term, the separation of transmission assets and operations from generation and distribution will be desirable.

4.8. Structure of the power pool when it becomes functional

The new project implementation strategy which determines the arrangements for asset management should take into account the ultimate structure, rules and participants in the functional power pool. Appendix 1 provides an example of the players in the functional power pool. They consist of IPPs, national transmission owners and operators, regional transmission owners and operators (transmission utilities), the regulators and the Independent System Operator, i.e., the information coordination, control and dispatch centre. Within the framework of this structure, generation, whether by IPPs, PPPs or even Government owned and operated can be provided by SPCs. Transmission lines dedicated to cross border transactions can also be operated by SPCs. All generation plants and dedicated cross border transmission lines in the priority projects can therefore be developed using SPCs.

Selection of vehicles to be used for transmission lines which serve both national and cross border purposes however need to be chosen on case by case basis. A practical example today is the decision to let each of SONABEL and GRIDCo develop the portion of the Bolgatanga – Ouagadougou line in its territory, even after the Supplementary Acts adopting the use of SPCs for development of regional transmission lines had been adopted. A possible solution is to establish an umbrella WAPP transmission line and operations SPC with subsidiaries in member countries, including possibly the transmission utilities.

4.9. Project responsibility allocation and the use of the SPC

The project cycle for all the Priority Projects will be classified into three (3) broad stages for discussion in this section as follows:

1) Phase1 entails:

- Project Conception/Pre-feasibility Studies
- Procurement of consultants for feasibility studies
- Coordinate the review and approval of the feasibility studies by the WAPP Executive Board and the participating countries/utilities
- Mobilization of Financing
- Preparation of bidding documents identification of contractor(s)

2) Phase 2 entails:

- Contract Negotiations and Awards

3) Phase 3 entails:

- Contract Effectiveness
- Project Implementation and Monitoring
- Operations and Maintenance

Responsibility is now allocated to the participating entities based on their ability to manage the complexity and risks associated with each stage.

Phase 1

WAPP Secretariat has the authority and support of the various ECOWAS Heads of State to and is already playing a leading role in mobilizing WAPP countries to participate in;

- Project Conception/Pre-feasibility Studies
- Procurement of consultants for feasibility studies
- Coordinate the review and approval of the feasibility studies by the WAPP Executive Board and the participating countries/utilities, and

- Mobilization of Financing.

This development phase of any project involves multiple and varied tasks cut across various sectors of the economy. Some of these include land and/or right of way acquisition, acquisition of various permits and licenses which requires good links/influence in the entire economy. The involvement of participating countries, especially at high levels of representation from their governments, will facilitate the resolution of such matters. It will also expedite decision making as the assignment of roles will take into account which party is best resourced to manage the associated risks or provide the required ingredient of the project. It will also keep key decision makers constantly aware of the existence of the project and any challenges faced on various aspects of the project which will facilitate decision making, especially when approvals are required from the various. The chosen representative(s) of the sponsoring countries and the WAPP project team could form an Oversight Committee/Steering Committee/Project Implementation Unit to coordinate the activities of all consultants engaged on the project.

This stage also involves the negotiation of vital project documents like the Power Purchase Agreement and the term sheets for financing. Collaboration between the WAPP Secretariat and ERERA to develop a standard PPA format could facilitate these negotiations. Specialized expertise is required for these activities, usually beyond the WAPP secretariat and the utilities and therefore reputable legal firms and investment bankers should be recruited as consultants to assist in this process. It will be prudent to start involving representatives of the SPC at this stage, even though the PIU continues to play the leading role.

It takes long periods for prospective investors to negotiate bankable PPAs for electricity supply even in individual countries due partly to the poor state of individual utilities and the need for credit support, usually from the government as owner of the utility. This will be more complicated in the WAPP regional context because the load is an aggregated demand from different countries and requires the negotiation of multiple PPAs. The presence of a unit/entity in WAPP that could aggregate the demand of the individual countries into a sizable demand to support the construction of an economically efficient plant could facilitate the process. This aggregator could be backed by guarantees from facilities available at the regional level such as the ECOWAS Bank for Investment and Development, African Development Bank, African Finance Corporation and the World Bank.

Phase 2

The next stage is the Contract negotiations and awards.

The contract award involves parties that are legally recognized and established. This has been done in the past by the individual utilities developing specific segments of the project. Under the new approach it will be necessary at this stage to appoint and mandate some key officers of the SPC to join the SPC and in order to take part in the negotiation and execution of the contracts.

Phase 3

The PIU should play the leading role in construction management while the SPC is being fully established. The SPC will then have full responsibility for arranging the operations and management of the facility.

4.10. Conclusions and recommendation

4.10.1. Conclusions

The major factors affecting the pace of implementation of the WAPP priority projects include:

- Inability to match commissioning of transmission projects with commissioning of adequate generation. This led to deficits in supply still persisting even after some interconnection projects have been completed. The situation has compelled the countries to continue to pursue their individual supply programs instead of committing fully to the WAPP regional program.

- Limited ability of the General Assembly and Executive Board to execute WAPP decisions which require action from other sectors of their countries' economies. This is because members of these teams are mainly energy industry experts who do not necessarily have the links and influence on other sectors whose actions impact on WAPP activities. The constitution of the Board of Directors of the GCC Interconnector Authority is a good example of how state participation in project development has worked successfully.

- The approach adopted for implementation of cross-border transmission projects has led to delays due to lack of convergence in priorities between different countries, differences in economic conditions and differences in project management capabilities.

- Non availability of gas in sufficient quantities for power generation in the region is likely to cause further delays in the commissioning of the Maria Gleta and Takoradi Thermal Plants.

- The poor financial state of the utilities has been a major obstacle to mobilization of funding for the projects.

- Inadequate human and financial resources to meet the requirements of the WAPP Organization in project conception, development and implementation.

4.11. Recommendations

To ensure the effective implementation of the WAPP generation and transmission master plan, it is recommended:

- Closer collaboration between WAPP and its member countries/utilities and sub-regional organizations to ensure harmonization of power supply planning, synchronization of periodic updates of such plans and funds mobilization for priority projects. This will ensure greater commitment from the countries to the regional projects.
- The Specific Purpose Company (SPC) approach is an effective project implementation approach that can mitigate or eliminate the major weaknesses associated with the old implementation approach. SPCs could therefore take part in the contracts award, implementation monitoring stages and take full control of the operations and maintenance
- WAPP does not lack sources of funding for its initiatives. But the poor financial state of the utilities is a constraint on WAPP's operations. It does not provide comfort to lenders to support the projects. WAPP should therefore continue to advocate and to support individual country initiatives towards greater private sector involvement in the management of public utilities, pre-paid metering, investments in distribution loss reduction and efficiency in energy use as a means of improving the viability of the utilities. It should collaborate with ERERA and the national regulators to include benchmarks and specific targets to be achieved for loss reduction, bill collection and energy efficiency. The choice of cost reduction initiatives as against a tariff increase is informed by the fact that WAPP utility tariffs are already the highest on the African continent.
- The high upfront capital costs of some renewable technologies such as wind and solar energy adversely affects their viability when normal sources of financing are used. WAPP should explore the use of other financial products such as Carbon Credits as well as other concessionary funding windows that are available in the European Union, African Development Bank, the World Bank (IFC) for the financing of some of these renewable energy projects.
- A regular source of funding is required for the WAPP's project development activities. This should start with a legal enforcement of the provisions in the Articles of Association. Designing the WAPP priority program in such a manner as to include solutions to the immediate needs of individual countries in the very early stages of the program could also provide the motivation for countries to support and subscribe to funding of WAPP activities, willingly. The establishment of an ECOWAS Infrastructure Development Fund through special levies/subscriptions by member countries and institutions is another option that could be pursued by ECOWAS. The West African Economic and Monetary Union (WAEMU/UEMOA) has established a similar fund already. Such a fund could be leveraged with resources from multilateral institutions such as the World Bank, African Development Bank, ECOWAS Bank for Infrastructure and Development, The Bank for West Africa's Development and the ECOWAS Commission. An institution such as the African Finance Corporation has a lot of interest in infrastructure development the desire to play the role of a lead arranger in the mobilization of funding for viable WAPP projects.

- Finally we recommend the establishment of a WAPP Aggregator Unit/Entity. This entity could gather the small demands of individual countries into a bulk demand, expedite negotiations of bankable Power Purchase Agreements (PPA) for electricity supply at the regional level and secure appropriate payment security instruments from multilateral guarantee agencies. The creation of the National Bulk Energy Trading Company in Nigeria with the necessary guarantees from the World Bank Group and the Nigerian government is one of the ways a similar situation has been handled.

5. FINAL LIST OF PRIORITY PROJECTS

The investments composing the global development program of the West African electrical system are classified hereafter.

At first, the national projects, decided and selected among the candidates, are reminded. These projects are a part of the development plan, and the electrical network development at regional level relies also on their implementation. Nevertheless, whatever their importance, these projects were not labeled as regional projects.

Regional generation projects, which will be supported by the WAPP and shared among the countries, were selected based on the following criteria:

- A minimum size of 150MW;
- A regional vocation (location, energy sharing between neighboring countries, regional importance);

At last, the regional priority projects, for generation and transmission, are presented in details. They are then classified into four categories depending on the emergency of their implementation and the interactions that could exist between them are illustrated.

5.1. National projects of the global development program

At first, the decided generation projects that are part of the national development program of the countries are presented. These projects were considered as decided and were not optimized.

Secondly, the national generation projects that were selected by the optimization among the candidate projects are listed.

5.1.1. Decided national generation projects

Senegal:

- The location of a 50 MW diesel unit in 2011 for a period of one year, with possibility to hire an additional 100 MW.
- The rehabilitation of the groups C3 and C4 in Bel Air (+30MW in 2011 and 25MW in 2012).
- The extension of group C6 in Bel Air: 2 x 15 MW in 2012.
- The commissioning of Koudi II (2 x 15 MW) in 2012.
- A biomass unit of 2 x 15 MW in Ross Behtio in 2014 with an estimated yearly production of 236 GWh.

The Gambia:

- Complete recommissioning of the units in Kotu.
- The rehabilitation of the unit G6 in Kotu in 2011.
- The rehabilitation of the unit G2 (HFO) in Kotu (3 MW) in 2012.
- The installation of two new diesel units of 6.5 MW running on HFO at Brikama power plant at the end of 2011.
- The installation of an additional 9 MW running on HFO also at the end of 2011.
- Four new units of 2 MW running on HFO for isolated centers.
- The construction of a wind farm of 1 MW in Tanji in 2012;

Guinea Bissau:

- The capacity installed presently is approximately 5.6 MW. But the capacity available continuously is 5 MW (2.5 MW EAGB and 2.5 MW location)
- 2 groups of 2.5 MW financed by the World Bank and installed in 2012. With the commissioning of these units, the location contracts will be stopped.
- A financing of 15 MW HFO for the city of Bissau supported by UEMOA and BOAD. Foreseen with several stages of 5 MW between 2012 and 2014.
- Rehabilitation of EAGB power plant in Bissau (2 MW)
- Rehabilitation of Bafata plant (5 MW)
- Commissioning of Buba plant (5 MW)
- It is also assumed that, when the production means will be sufficient, the auto-producers will stop using their own production means.

Guinea:

- 106 MW with the thermal project of Manéah running on HFO. The commissioning is expected between 2014 and 2015.
- Additional 100 MW in Tombo.
- The rehabilitation of thermal and hydro units in Guinea.

Sierra Leone: no national projects decided

Liberia:

- 10 MW fast diesel groups (10 X 1MW) running on DDO on the site of Bushrod. Commissioning expected in 2011.
- 10 MW semi-fast diesel groups (2 X 5MW) running on HFO on the site of Bushrod. Commissioning expected in 2013.

Mali:

- 60 MW of the BID project (6 diesel groups of 10 MW each) running on HFO in Balingué. 40 MW have already been commissioned in 2010. The commissioning of the 20 MW remaining is envisaged in 2011;

- 92 MW through the IP Albatross thanks to diesels groups running on HFO in the mining zone of Kayes. The commissioning is envisaged in 2012;
- The connection of isolated diesel groups to the interconnected system, representing 30.4 MW at the study horizon.
- A solar project at Mopti for 10 MW installed in 2012 and connected to the interconnected network in 2019.

Ivory Coast:

- An additional 222 MW on CIPREL (independent producer) site to form a combined cycle with the 111 MW gas turbine commissioned in 2010. The commissioning of the new gas turbine is foreseen for July 2012 and the new steam turbine in July 2013.
- An emergency addition of 250 MW (total 450 MW) on CIPREL's site or Vridi thanks to a new gas turbine and a new steam turbine in 2012.
- A 450 MW combined cycle (2 GT and one ST of 150 MW each) on the site of Abbata. The commissioning is expected for 2014 (first GT), 2015 (second GT) and 2016 (ST).

Ghana:

- Phase 1 of power plant T3 of Aboadze (in construction), which will consist of a combined cycle of 120 MW. Its commissioning is planned for 2012;
- A second gas turbine of 110MW on the site of Tema T1 with commissioning envisaged in 2012. The addition of a steam turbine of 110 MW is envisaged in 2015 to create a combined cycle of a total of 330 MW;
- Hydroelectric dam of 400 MW in Bui on the Black Volta with an annual producible of 1000 GWh. The commissioning is planned for mid 2013;
- Two gas turbines of 110 MW each one envisaged in Domini by BTPP (Domini plant T1) in order to benefit from the offshore gas resources discovered. Their commissioning is envisaged in 2013;
- Addition of a steam turbine of 110 MW on the power plant of Aboadze T2 to pass to a combined cycle of 330 MW in total. The commissioning is envisaged in 2014;
- 2x5MW solar PV in 2012 and 2013;
- Wind: 50 MW in 2014 and 100 MW in 2015;

Togo: no national projects decided

Benin:

- 80 MW on the site of Maria Gleta in Cotonou. The commissioning is envisaged in 2011;

Burkina Faso:

- 18 MW running on HFO and forming the first phase of the power plant of Komsilga. The commissioning is envisaged in 2011;

- 37.5 MW (3 diesel groups of 12.5 MW running on HFO and forming the 2nd phase of the power plant of Komsilga. The commissioning is envisaged in 2011;
- 36 MW (2 diesel groups of 18 MW) running on HFO which will form the 3rd phase of the power plant of Komsilga (total 90MW). The commissioning is envisaged in 2013;
- 20 MW (2 diesel groups of 10 MW running on HFO and forming the 2nd phase of the power plant of Bobo 2. The commissioning is envisaged in 2012.

Niger:

- In 2011, seven 2.2 MW diesel units each will be installed with the power plant of Niamey 2, to replace the old diesel units;
- In 2012, 2 units of 2MW each will be installed in Maradi and 2 others of 2 MW will be installed in Zinder, in Centre-East Niger area;
- In the river area, an additional diesel power of 70MW will be installed in Niamey in 2013.
- In the River area, the Kandadji dam will be completed by 2015. This 130 MW dam should bring 629 GWh annually to Niger;

Nigeria:

- FGN phase 1:1408 MW of which 1055 MW were commissioned in 2007. There remain 353 MW planned for 2011;
- NIPP: 2599 MW planned for 2011;
- FGN phase 2:2148 MW envisaged including 696 MW for 2012 and 1452 MW for 2013.

Besides, the oil companies envisaged the following investments:

- The power plant of Afam 6, by Shell: 5 units of 150 MW in 2012;
- The power plant of Bonny, by Mobil: 3 units of 130 MW in 2012;
- The Chevron Texaco power plant with 3 units of 250 MW by 2012;
- The power plant of TotalFinaElf with 4 units of 125 MW by 2012.

Moreover, some IPP are expected:

- Alscon with 6 units of 90 MW by 2012;
- Power plant IBOM Power 2 with 500 MW in 2012.

5.1.2. National generation projects selected among the candidate projects:

Senegal:

Name	*Technology*	*Fuel*	*Commissioning*	*Capacity*
Ziguinchor	Diesel	HFO	2012	2*5 MW
Tambacounda	Diesel	HFO	2012	2*4 MW

The Gambia:

Name	*Technology*	*Fuel*	*Commissioning*	*Capacity*
Brikama Extension	Diesel	HFO	2015	2*10 MW
Gambia Wind 1	Wind Turbine	WIND	2014	4 MW
Gambia Wind 2	Wind Turbine	WIND	2015	6 MW

Guinea Bissau:

Name	*Technology*	*Fuel*	*Commissioning*	*Capacity*
Bissau	Diesel	HFO	2015	55 MW

Guinea:

Name	*Technology*	*Fuel*	*Commissioning*	*Capacity*
Poudalde	Hydro	HYDRO	2017	90 MW
Kouravel	Hydro	HYDRO	2021	135 MW

Sierra Leone:

Name	*Technology*	*Fuel*	*Commissioning*	*Capacity*
BENKONGOR 3	Hydro	HYDRO	2018	85 MW

Liberia:

Name	*Technology*	*Fuel*	*Commissioning*	*Capacity*
SAINT-PAUL 1B	Hydro	HYDRO	2020	78 MW
SAINT-PAUL 2	Hydro	HYDRO	>2020	120 MW

Mali:

Name	*Technology*	*Fuel*	*Commissioning*	*Capacity*
KENIE	Hydro	HYDRO	2016	42 MW

Ivory Coast:

Name	*Technology*	*Fuel*	*Commissioning*	*Capacity*
ABOISSO COMOE	Hydro	HYDRO	2018	90 MW
GRIBO POPOLI	Hydro	HYDRO	>2020	112 MW

Ghana:

Name	*Technology*	*Fuel*	*Commissioning*	*Capacity*
SAP (CC)	Combined Cycle	NAT GAS	2014/2015	2*163.6 MW
Cempower (CC)	Combined Cycle	NAT GAS	2015/2016	300 MW
Pwalugu	Hydro	HYDRO	2019	48 MW
Juale	Hydro	HYDRO	2019	87 MW
Hemang	Hydro	HYDRO	2019	93 MW
Domini T1 (ST)	Combined Cycle	NAT GAS	2020	110 MW
Aboadze T3 (CC)	Combined Cycle	NAT GAS	>2020	120 MW

Togo-Benin:

Name	*Technology*	*Fuel*	*Commissioning*	*Capacity*
Kétou (Benin)	Hydro	HYDRO	2020	160 MW

Burkina Faso: no national projects selected

Niger:

Name	*Technology*	*Fuel*	*Commissioning*	*Capacity*
River area	Wind	WIND	2014	30 MW
Dyodonga	Hydro	HYDRO	2018	26 MW

Nigeria:

Name	*Technology*	*Fuel*	*Commissioning*	*Capacity*
Standards	Combined Cycle	NAT GAS	2016-2021	1000 MW/y

5.2. Regional projects of the global development program

This section presents the priority projects that were retained as regional projects.

A description of each project is given with its characteristics, its estimated cost and its progress status. The adequacy with the Regional Transmission Master Plan (proximity and / or coupling with a transmission project) is presented.

At last, the progress of the studies is given for each project with the following abbreviations:

- Identification: no studies available but project idea
- FS : Economic and technical feasibility study
- ESIS : Environmental and social impact study
- DS : Detailed study
- CS : Complementary study

5.2.1. Description of priority projects

1- Project of coal power plant in **Sendou** (Senegal)

Project consisting in the building of a 875MW coal plant composed of 7 units of 125 MW each and located at **Sendou**, near Dakar in Senegal.

Characteristic of generating unit:

Sendou – 875 MW – 7 x 125 MW

Estimated cost: 2532 M$

Characteristic of the linked transmission project:

There is no transmission project linked to this generation project. However, this is a big project and it will be important to close the 225kV loop of Dakar network.

Moreover, the reinforcement of the local network between the plant and the consumption centers will be needed to be able to evacuate the power generated.

Total cost of the project:

2532 M$

Foreseen date of commissioning:

2016

Comments:

Decided project

Progress of studies:

Identification status

2- Gouina project: Interconnection Kayes (**Mali**) –Tambacounda (**Senegal**) for evacuating the power of **Gouina** hydroelectric plant

Project consisting in the building of a hydroelectric plant of 140MW at Gouina in Mali and in the commissioning of an interconnection line Kayes (Mali) – Tambacounda (Senegal) to share the power generated by Gouina.

Characteristic of generating unit:

Gouina – 140 MW – 565 GWh

Estimated cost: 329 M$

Characteristic of the linked transmission project:

225kV line allowing the share of the electricity between the two countries

Length of the line: 280 km

- 225kV sub-station at Kayes (existing thanks to OMVS Project)
- 225kV sub-station at Tambacounda (To be commissioned in the frame of OMVG loop)

Estimated cost: 65 M$

Total cost of the project:

394 M$

Foreseen date of commissioning:

2017-2019

Comments:

Generation project decided

Transmission project essential for the share of generated energy at Gouina

Progress of studies:

Hydroelectric plant: FS and ESIS available

Transmission project: FS in progress

3- Wind farm 200 MW **Senegal- the Gambia**

Project consisting in exploiting the potential of the region and in reducing the energy dependence of Senegal and the Gambia

Total cost of the project:

318 M$

Foreseen date of commissioning:

In stages of 50 MW between 2017 and 2021

Comments:

Reduction of energy dependence of countries/regions

Progress of studies:

Identification status

4- Hydroelectric plants of **Boureya** (OMVS) – **Badoumbé** (OMVS) – **Balassa** (OMVS) and **Koukoutamba** (OMVS) and interconnection between Linsan (**Guinea**) and Manantali (**Mali**)

In the frame of OMVS the building of 4 hydroelectric plants is foreseen in Guinea and Mali. The power should be evacuated through an interconnection line between Linsan (**Guinea**) and Manantali (**Mali**).

Characteristic of generating units:

Balassa – 181 MW – 401 GWh – 171 M$ (commissioning in 2017-2019)

Badoumbé – 70 MW- 410 GWh – 197 M$ (commissioning in 2017-2019)

Koukoutamba – 281MW – 455 GWh – 404 M$ (commissioning in 2019-2021)

Boureya – 160 MW- 455 GWh – 373M$ (commissioning in 2021-2023)

Estimated cost of plants: 1145 M$

Characteristic of the linked transmission project:

225kV double circuit line between Linsan (Guinea) and Manantali (Mali) to share the electricity produced by the 4 hydroelectric plants

The route of this transmission line will be evaluated in the frame of the master plan of OMVS.

Commissioning of the first circuit: 2017-2019 and of the second circuit: 2019-2021.

Estimated cost (for information as it will be dependant on the route): 131 M$

Moreover, the transmission line Manantali-Bamako-Sikasso will need to be reinforced to allow the evacuation of this hydroelectric generation through Mali.

Commissioning between 2019 and 2021

Cost of this reinforcement: 151M$

Total cost of the project:

1427 M$

Foreseen date of commissioning:

Commissioning in 3 stages

- 2017-2019 : First circuit of OMVS line and commissioning of hydroelectric plants of Balassa and Badoumbé
- 2019-2021: Commissioning of the third hydroelectric plant (Koukoutamba), second circuit of transmission line between Linsan and Manantali and reinforcement of the Manantali-Sikasso-Bamako line.
- > 2021: Commissioning of the fourth hydroelectric plant (Boureya).

Comments:

The route of the Linsan-Manantali line should take into account the environmental context.

Progress of studies:

Transmission project: FS in progress

Generation projects: Balassa – identification

Badoumbé – FS available

Koukoutamba – FS in progress

Boureya - identification

5- Interconnection project **Ghana-Burkina Faso-Mali**

225kV interconnection line between the North of Ghana and the region of Bamako (Mali) via Bobo Diolasso (Burkina Faso).

Characteristic of transmission project:

225kV line allowing the share of electricity between the 3 concerned countries.

Length of the line: 742 km

- 225kV sub-station at Bolgatanga in Ghana (To be commissioned in the frame of the Bolgatanga-Ouagadougou interconnection line)
- 225kV sub-station at Kodeni (Bobo Diolasso) in Burkina Faso (Existing)
- 225kV sub-station at Sikasso in Mali (to be commissioned in the frame of Mali Ivory-Coast interconnection))
- 225kV sub-station at Kodialani (Bamako) in Mali (existing)

Estimated cost: 230 M$

Total cost of the project:

230 M$

Foreseen date of commissioning:

2015

Comments:

Decided project

Progress of studies:

FS and ESIS available

Additional studies in progress

6- Hydroelectric plant of **Kaleta**

Project consisting in the building of a run of river hydroelectric plant in Kaleta (240 MW)

Characteristic of generating unit:

Kaléta – 240 MW – 3 x 80 MW - 946 GWh

Estimated cost: 267 M$

Characteristic of the linked transmission project:

The power produced in Kaleta will need to be partially evacuated through the OMVG transmission network.

Total cost of the project:

267 M$

Foreseen date of commissioning:

2015

Comments:

Decided project

Progress of studies:

DS and ESIS available

7- OMVG project : **225 kV loop** between Senegal, the Gambia, Guinea-Bissau and Guinea, and hydroelectric unit of **Sambangalou**

Project consisting in the commissioning of a 128 MW dam in Sambangalou, and of a 225kV loop interconnecting four countries.

Characteristic of generating unit:

Sambangalou – 128 MW – 4 x 32 MW - 402 GWh

Estimated cost: 433 M$

Characteristic of the linked transmission project:

The OMVG loop will interconnect 4 countries and will have a length of 1677 km. It will include 15 sub-stations and will cost 576.5 M$.

Total cost of the project:

1009.5 M$

Foreseen date of commissioning:

Commissioning in stages

- Linsan-Labé-Mali till 2015 ;
- Linsan- Kaolack- Tambacounda till 2015 ;
- Tambacounda-Mali in 2017.

Comments:

Decided project

Progress of studies:

225kV loop: DS and ESIS available

Generation project: DS and ESIS available

8- Hydroelectric plat of **Digan** (OMVG)

Project consisting in the building of the hydroelectric plant of Digan (93.3MW) in the frame of OMVG

Characteristic of generating unit:

Digan – 93.3MW - 243 GWh

Estimated cost: 112 M$

Characteristic of the linked transmission project:

The power of Digan will need to be evacuated in the OMVG loop

Total cost of the project:

112 M$

Foreseen date of commissioning:

After the building of the OMVG line and the decided projects of OMVG (> 2021)

Comments:

/

Progress of studies:

Identification status

9- Hydroelectric plant of **Souapiti**

Project consisting in the building of a 515 MW hydroelectric plant in Souapiti (Guinea).

This project will need the commissioning of the decided interconnection projects (OMVG; CLSG; Guinea-Mali)

Characteristic of generating unit:

Souapiti – 515MW - 2518 GWh

Estimated cost: 796M$

This cost takes into account an over cost due to the environmental impact of this project.

Characteristic of the linked transmission project:

Such a capacity will need to be evacuated through the main interconnection axis (OMVG; CLSG; Guinea-Mali).

Total cost of the project:

796 M$

Foreseen date of commissioning:

2017-2019

Comments:

Important environmental impact

Progress of studies:

FS available

10- Hydroelectric plant of **Amaria**

Project consisting in the building of the hydroelectric plant of Amaria (Guinea) – 300MW.

This project will need the commissioning of the decided interconnection projects (OMVG; CLSG; Guinea-Mali)

Characteristic of generating unit:

Amaria – 300MW - 1435 GWh

Estimated cost: 377M$

Characteristic of the linked transmission project:

Such a capacity will need to be evacuated through the main interconnection axis (OMVG; CLSG; Guinea-Mali).

Total cost of the project:

377 M$

Foreseen date of commissioning:

2019-2021

Comments:

/

Progress of studies:

Identification status

11- Hydroelectric plant of **Grand Kinkon and** reinforcement of Western section of OMVG loop

Project consisting in the building of the hydroelectric plant of Grand Kinkon (Guinea) – 291 MW.

This project will need the commissioning of the decided interconnection projects (OMVG; CLSG; Guinea-Mali)

Characteristic of generating unit:

Grand Kinkon – 291MW - 720 GWh

Estimated cost: 298 M$

Characteristic of the linked transmission project:

Such a capacity will need to be evacuated through the main interconnection axis (OMVG; CLSG; Guinea-Mali).

Moreover, the western section of OMVG loop will need to be reinforced with the commissioning of a second line.

Estimated cost: 141 M$.

Total cost of the project:

439 M$

Foreseen date of commissioning:

>2021

Comments:

/

Progress of studies:

FS available

12- Hydroelectric plant of **Kassa** (Guinea/Sierra Leone)

Project consisting in the building of the 135 MW hydroelectric plant of Kassa at the borders between Guinea and Sierra Leone, on the route of CLSG interconnection.

Characteristic of generating unit:

Kassa – 135 MW - 528 GWh

Estimated cost: 214 M$

Characteristic of the linked transmission project:

Depending of the national and regional generation projects in the CLSG countries and especially the Bumbuna project, the second circuit of CLSG transmission line could be needed to evacuate the power of Kassa.

Total cost of the project:

214 M$

Foreseen date of commissioning:

2019-2021

Comments:

/

Progress of studies:

Identification status

13- Interconnection project CLSG

Interconnection project between Ivory Coast, Liberia, Sierra Leone and Guinea.

Characteristic of transmission project:

This is a double circuit 225 kV line. In a first stage, only one circuit will be installed. The second circuit is foreseen at middle-term, depending on the hydroelectric development in the region.

Length of the line: 1060 km

Estimated cost: 430 M$

Total cost of the project:

430 M$

Foreseen date of commissioning:

2015

Comments:

Decided project

Progress of studies:

FS available

ESIS in progress

14- Hydroelectric plant of **Mount Coffee** (Liberia)

Project consisting in the commissioning of a hydroelectric plant of 66MW in Mount Coffee (Liberia)

Characteristic of generating unit:

Mount Coffee – 66 MW - 435 GWh

Estimated cost: 383 M$

Characteristic of the linked transmission project:

This project is linked to the CLSG interconnection project, in order to share the energy generated.

Total cost of the project:

383 M$

Foreseen date of commissioning:

2015

Comments:

Decided project

Progress of studies:

FS available

15- Hydroelectric plant of **Bumbuna** (Sierra Leone) and reinforcement of the CLSG line

Project consisting in the building of a hydroelectric plant of 350MW in **Bumbuna** (Sierra Leone) and the reinforcement of the CLSG line.

Characteristic of generating unit:

First stage existing + second stage + Extension of the first stage

Total: 400 MW – 1560GWh

Estimated cost for the building of the second stage and the extension of the first stage: 520M$.

Characteristic of the linked transmission project:

Second circuit of the 225kV « CLSG» line

The studies available foresee the installation of two circuits on this route at middle-term. This second circuit should be commissioned to evacuate the power produced by Bumbuna, allowing the share of energy between the CLSG countries.

Length of the line: 1060 km

Estimated cost: 69 M$

Total cost of the project:

589 M$

Foreseen date of commissioning:

2017-2019

Comments:

/

Progress of studies:

FS and ESIS available for the generation project Bumbuna 2+ Yiben

16- Hydroelectric plant of **Félou** (OMVS)

Project consisting in the building of a hydroelectric plant of 60MW at **Félou** (Mali)

Characteristic of generating unit:

Félou – 60 MW - 350 GWh

Estimated cost: 170 M$

Characteristic of the linked transmission project:

Thee power generated by Felou will be evacuated through the OMVS interconnection. This interconnection already exists and does not need any reinforcement to evacuate the additional power linked to Felou plant.

Total cost of the project:

170 M$

Foreseen date of commissioning:

2013

Comments:

Decided project

Progress of studies:

Construction in progress

17- Solar project 150 MW **Mali**

Project consisting in exploiting the solar potential of the country and in reducing the energy dependence of Mali

Total cost of the project:

549 M$

Foreseen date of commissioning:

In stages between 2019 and 2021

Comments:

Reduction of energy dependence du pays

Progress of studies:

Identification status

18- Interconnection project Ségou (**Mali**)- Ferkessédougou (**Ivory Coast**)

Interconnection project between Ferkessédougou (Ivory Coast) and Ségou (Mali).

This project will be extended in Ivory Coast with the Laboa-Ferkessédougou axis to allow the feeding of Mali from the South of Ivory Coast (gas and hydro resources).

Characteristic of transmission project:

The following 225kV substations will be built:

- Ferkessédougou (Ivory Coast) (existing thanks to the interconnection Ivory Coast-Burkina Faso)
- Sikasso (Mali) (to be built)
- Ségou (Mali) ((to be built)

Length of the line: 370 km

Estimated cost: 175 M$

Characteristic of the reinforcement project of the Ivorian network:

The following 225kV substations will be built:

- Ferkessédougou (existing)
- Boundiali (to be upgraded from 90kV to 225kV)
- Laboa (existing)

Length of the line: 285 km

Estimated cost: 100 M$

Total cost of the project:

175 M$

Foreseen date of commissioning:

2012

Comments:

Decided project

Progress of studies:

Construction in progress

19- Hydroelectric plant of **Tiboto** and interconnection Buchanan (**Liberia**) –San Pedro (**Ivory Coast**)

Project consisting in the building of a 225MW hydroelectric plant in Tiboto at the borders between Liberia and Ivory Coast and the commissioning of a transmission line Buchanan (Liberia) –San Pedro (Ivory Coast).

Characteristic of generating unit:

Tiboto – 225 MW – 912 GWh

Estimated cost: 578 M$

Characteristic of the linked transmission project:

225kV line allowing the share of electricity between Liberia and Ivory Coast.

Length of the line: 400 km

- 225kV sub-station at Buchanan (Commissioning in the frame of CLSG)
- 225kV sub-station at San Pedro (existing)
- 225kV sub-station at Tiboto (to be built)

Estimated cost: 100 M$

Total cost of the project:

678 M$

Foreseen date of commissioning:

2019-2021

Comments:

Technical difficulties linked to the building of a transmission line in wet regions

Progress of studies:

Identification status

20- Hydroelectric plant of **Fomi** and interconnection **Guinea-Mali** (Fomi –Linsan, –Nzerekoré, –Bamako)

Project consisting in the commissioning of an interconnection between Guinea and Mali and in the building of West-East and Centre-South axis in Guinea allowing the evacuation of the hydroelectric unit of Fomi.

Characteristic of generating unit:

The plant of **Fomi** is located at the origin of an interconnection line between Fomi (**Guinea**) and -Nzerekoré (**Guinea-South**) and between Fomi (**Guinea**) and Bamako (**Mali**). Even if its power is quite limited, this unit can be considered as regional thanks to its location.

Fomi – 90 MW – 374 GWh

Estimated cost: 156 M$

Commissioning: 2017-2019

Characteristic of transmission project:

225kV line:

Part 1: Linsan-Fomi – 430 km

Part 2: Fomi -Nzerekoré – 400 km

Part 3: Fomi – Bamako –520 km

- 225kV sub-station at Fomi (to be built)
- 225kV sub-station at Linsan (commissioning in the frame of CLSG and OMVG projects)
- 225kV sub-station at Nzerekoré (commissioning in the frame of CLSG project)
- 225kV sub-station in Bamako (existing)

Estimated cost: 550 M$

Comments:

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Progress of studies:

Transmission project: Identification status

Hydroelectric project: FS and ESIS available

21- Interconnection Fomi (**Guinea**) – Boundiali (**Ivory Coast**)

This projects consists in a new interconnection line allowing the evacuation of power produced by hydroelectric units in Guinea (and especially in Fomi) to the North-East of the region.

Characteristic of transmission project:

225kV double circuit line between Fomi (**Guinea**) and Boundiali (**Ivory Coast**) allowing the share the energy produced in Guinea with other countries.

The route of this line has to be defined in a specific study. It should link the two following sub-stations:

- 225kV sub-station at Fomi (Commissioning in the frame of Guinea-Mali interconnection project)
- 225kV sub-station in Boundiali (Commissioning in the frame of 225kV Laboa-Ferkessédougou line in Ivory Coast)

Commissioning: 2017- 2019

Length of the line: 380 km

Estimated cost (for information as it will be dependant of the route): 111 M$

Characteristic of the reinforcement of evacuation axis

In order to be able to evacuate the power from Guinea to the North of Ivory Coast and Burkina Faso, the network has to be reinforced ahead and behind the interconnection line Fomi-Boundiali.

- Inside **Guinea** (Linsan-Fomi line).
- Inside **Ivory Coast** (Boundiali-Ferkessédougou axis), **between Ivory Coast and Burkina Faso** (Ferkessédougou -Bobo) and **inside Burkina Faso** (Bobo-Ouaga)

These axes are existing/decided but a single circuit has been foreseen. Therefore new lines will need to be commissioned.

For the lines that are not yet in construction or achieved, the studies should consider the possibility to install a second circuit at middle-term as the needs are important.

Reinforcements needed	**Voltage level**	**Length**	**Reinforcement cost**
Linsan-Fomi (Guinea) *(second line)*	225	430 km	65
Boundiali- Ferke (Ivory Coast) *(second line)*	225	157 km	59
Ferke (Ivory Coast) –Bobo (Burkina Faso) *(second line)*	225	221 km	
Bobo – Ouaga (Burkina Faso) *(second line)*	225	338 km	44

Total cost of the project:

279 M$

Foreseen date of commissioning:

This project is very important to optimize the share of the generated energy between the countries of ECOWAS. However the commissioning of the Guinea-Mali interconnection is needed to make a sense to the Fomi-Boundiali interconnection.

As all the studies are still to be achieved, this project is envisaged between 2019 and 2021.

Comments:

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Progress of studies:

Identification status

22- Hydroelectric plant of **Soubré** (Ivory Coast) and reinforcement of the evacuation axis to Abidjan (Soubré-Taabo)

Project consisting in the building of a hydroelectric plant of 270MW in Soubré (Ivory Coast) and in the reinforcement of the line between Soubré and the consumption center of Abidjan (line Soubré-Taabo).

Characteristic of generating unit:

Soubré – 270MW - 1120 GWh

Estimated cost: 620 M$

Characteristic of the linked transmission project:

Reinforcement of the 225kV transmission line between Soubré and Taabo

Length of the line: 196 km

Estimated cost: 69 M$

Total cost of the project:

689 M$

Foreseen date of commissioning:

2017-2019

Comments:

/

Progress of studies:

FS and ESIS available

23- Interconnection project **Coastal Backbone**

Interconnection project following the coast between Nigeria and Ivory Coast.

Characteristic of transmission project:

The line goes through the following 330kV sub-stations:

- Ikeja West (Nigeria)(existing)
- Sakété (Benin) (existing)
- Lomé (Togo)(to be built)
- Volta (Ghana)(existing)
- Aboadze (Ghana)(existing)
- Prestea (Ghana)(to be built)
- Riviera (Ivory Coast)(to be built)

The sections Ikeja West-Sakete and Volta-Aboadze are built. The following sections have to be achieved:

- Between Ghana, Togo and Benin : Estimated cost 84 M$
- between Ghana and Ivory Coast : Estimated cost 57 M$

Estimated cost: 141 M$

Total cost of the project:

141 M$

Foreseen date of commissioning:

2013 for the section Ghana-Togo-Benin and 2017 for the section Ghana-Ivory Coast

Comments:

Decided project

Progress of studies:

Section Ghana-Togo-Benin under construction

Section Ghana-Ivory Coast EF and ESIS in progress

24- Project of thermal plant in **Aboadze** (Ghana)

400MW Combined cycle to be commissioned in 2014.

The power of Aboadze will be evacuated through the Coastal backbone (existing and future sections)

Characteristic of generating unit:

Aboadze – 400 MW

Estimated cost: 356 M$

Characteristic of the linked transmission project:

Evacuation through the Coastal backbone

Total cost of the project:

356 M$

Foreseen date of commissioning:

2014

Comments:

Decided project

Progress of studies:

Identification status

25- Interconnection Bolgatanga (**Ghana**) – Ouagadougou (**Burkina Faso**)

Interconnection project allowing the feeding of Ouagadougou region (Burkina Faso) from Ghanaian network (Bolgatanga).

Characteristic of transmission project:

225 kV line with the following sub-stations

- Ouagadougou (Burkina Faso) (existing)
- Bolgatanga (Ghana) (extension of the existing 161kV sub-station)

Total length of the line: 206 km

Estimated cost: 74 M$

Total cost of the project:

74 M$

Foreseen date of commissioning:

2013

Comments:

Decided project

Progress of studies:

Construction in progress

26- 330kV North-South Axis **Ghana**

Project consisting in the building of a 330kV line from the South of Ghana to the North in order to increase the capacity of exporting electricity to Burkina Faso.

Characteristic of transmission project:

330kV transmission line between Prestea and Bolgatanga

- 330kV sub-station at Prestea (existing in the frame of Coastal backbone project)
- 330kV sub-station at Kumasi (Extension of the 161kV sub-station)
- 330kV sub-station at Kintampo (Extension of the 161kV sub-station)
- 330kV sub-station at Bolgatanga (Extension of the 161kV sub-station, connection to local 161kV network and to 225kV line to Burkina Faso)

Length of the line: 640 km

Total cost of the project:

240 M$

Foreseen date of commissioning:

2017-2019

Comments:

Helps to exchange electricity from Ghana to Burkina Faso

Progress of studies:

FS available

ESIS and DS in progress

27- Hydroelectric plant of **Adjaralla** (Togo)

Project consisting in the building of a hydroelectric plant of 147 MW at **Adjaralla** (Togo)

Characteristic of generating unit:

Adjaralla – 147 MW - 366 GWh

Estimated cost: 333 M$

Characteristic of the linked transmission project:

Evacuation through the Coastal backbone

Total cost of the project:

333 M$

Foreseen date of commissioning:

2017

Comments:

Decided project

Progress of studies:

EF + EIES available

Additional studies in progress

28- Combined cycle project in **Togo** and reinforcement of Coastal Backbone

Project consisting in the building of a new combined cycle in Togo to exploit the gas from WAGP pipeline for electricity generation. The power will be evacuated through the Coastal Backbone

Characteristic of generating unit:

Togo CC – 450 MW

Estimated cost: 401 M$

Characteristic of the linked transmission project:

Depending on the generation projects in the different countries (Nigeria, Benin, Togo, Ghana and Ivory Coast); it could become required to reinforce the Coastal backbone to evacuate the power of the combined cycle of Togo

Cost of this reinforcement (section Lomé-Sakete): 46M$

Total cost of the project:

447 M$

Foreseen date of commissioning:

Project envisaged for the long-term, after the development of hydroelectric potential and after the other thermal projects decided by the WAPP or the countries: >2021

Comments:

/

Progress of studies:

Identification status

29- Project of thermal plant in **Maria Gleta** (Benin)

Combined cycle 450MW to be commissioned 2014.

The power of Maria Gleta will be evacuated through the Coastal backbone (existing and future sections)

Characteristic of generating unit:

Maria Gleta – 450 MW

Estimated cost: 401 M$

Characteristic of the linked transmission project:

Evacuation through the Coastal backbone

Total cost of the project:

401 M$

Foreseen date of commissioning:

2014

Comments:

Decided project

Progress of studies:

FS and ESIS available

30- Solar project 150 MW **Burkina Faso**

Project consisting in exploiting the solar potential of the country and in reducing the energy dependence of the region

Total cost of the project:

549 M$

Foreseen date of commissioning:

In stages between 2017 and 2019

Comments:

Reducing the energy dependence of the region

Progress of studies:

Identification status

31- Project North core

Project consisting in the building of 330kV lines to interconnect Nigeria-North, Benin-North, Niger (river zone) and Burkina Faso.

Characteristic of transmission project:

330kV transmission lines between:

- Birnin-Kebbi (Nigeria) and Zabori (Niger): 77 km
- Malanville (Benin) and Zabori (Niger): 94.7 km
- Niamey (Niger) and Zabori (Niger): 191 km
- Niamey (Niger) and Ouagadougou (Burkina Faso): 469 km

The following 330 kV substations are foreseen:

- Birnin-Kebbi (extension of existing sub-station)
- Niamey (Extension existing 132 kV sub-station)
- Malanville (to be built)
- Ouagadougou (to be built)

Total cost of the project: 540 M$

Total cost of the project:

540 M$

Foreseen date of commissioning:

2017-2019

Comments:

/

Progress of studies:

FS available

32- Hydroelectric plant of **Mambilla** and 760kV network

Project consisting in the commissioning of the hydroelectric plant of Mambilla (Nigeria) and in the building of a 760 kV network to allow the evacuation of Mambilla power to consumption centers of Nigeria and to interconnections with Niger and Benin.

Characteristic of generating unit:

Mambilla – 2600MW - 11214 GWh

Estimated cost: 4000 M$

Characteristic of the linked transmission project:

The 760 kV network is foreseen to be composed of the following lines and sub-stations:

- Erunkan-Oshogbo-Benin city North- Ajaokuta (Nigeria Centre-South to Lagos and Benin)- 850 km
- Benin city North-Egbema (Nigeria Centre-South to Nigeria South-East) -250 km
- Ajaokuta-Abuja-Kaduna-Kano (Nigeria Centre-South to Nigeria North and Niger) -640 km
- Ajaokuta-Makurdi-Mambilla-Jalingo-Gombe (Nigeria Centre-South to Mambilla and Nigeria North-East) -960 km

Estimated cost: 2000 M$

Total cost of the project:

6000 M$

Foreseen date of commissioning:

760kV transmission network:

As it is a new voltage level, all the infrastructures will need to be adapted: Commissioning foreseen: 2019-2021

Hydroelectric generation project:

Due to the size of the project (2600MW) and the need of the 760kV network to evacuate the power of Mambilla, this project has to be envisaged at more long-term: 2021.

Comments:

/

Progress of studies:

Generation project: Identification status

Transmission project 760kV: Identification status

33- Hydroelectric plant of **Zungeru** (Nigeria) and evacuation through the Median backbone

Project consisting in the building of a hydroelectric plant of 700MW in **Zungeru** (Nigeria) and the share of electricity between **Nigeria**, **Benin** North, **Togo** North and **Ghana** North (Median backbone Project)

Characteristic of generating unit:

Zungeru – 700 MW – 3019 GWh

Estimated cost: 1077 M$

Characteristic of the linked transmission project:

"Median backbone Project" 330kV

Length of the line: 713 km

- 330kV sub-station at Kainji (Nigeria) (Existing)
- 330kV sub-station at Bembereke (Benin) (Extension of the 161kV sub-station)
- 330kV sub-station at Kara (Togo) (Extension of the 161kV sub-station)
- 330kV sub-station at Yendi (Ghana) (to be commissioned in the frame of 330kV North-South Project in Ghana)

Estimated cost: 238 M$

Total cost of the project:

1315 M$

Foreseen date of commissioning:

2017-2019 for the generation project

2019-2021 for the Median Backbone

Before the commissioning of the Median Backbone, the power of Zungeru will be evacuated through the North Core and the Coastal Backbone to the other countries of ECOWAS.

Comments:

/

Progress of studies:

Generation project: FS and ESIS available

Transmission project Median Backbone: Identification status

34- Wind farm 300 MW **Nigeria-North**

Project consisting in exploiting the wind potential of Nigeria and in reducing the energy dependence of the North of the country

Total cost of the project:

477 M$

Foreseen date of commissioning:

In stages after 2021

Comments:

Decrease of dependence to fossil fuels

Progress of studies:

Identification

35- Reinforcement Benin-Nigeria

Project consisting in commissioning a new 330kV interconnection between the South of Benin and the South of Nigeria.

Characteristic of transmission project:

Double circuit 330 kV line between Sakete (Benin) and Omotosho (Nigeria

The 330kV sub-station of Sakete already exists. The one of Omotosho will be built in the same time as the power plant of Omotosho (Olorunsogbo). This line will allow evacuating the power directly to Benin.

Length of the line: 120 km

Total cost of the project:

39 M$

Foreseen date of commissioning:

Due to the commissioning of a combined cycle at Maria Gleta in Benin, this project is not a priority at short- and middle-term. Commissioning after 2021.

Comments:

/

Progress of studies:

Identification status

36- Project of coal power plant in **Salkadamna** (Niger) and connection to ECOWAS network

Project consisting in building a coal power plant of 200MW in **Salkadamna** (Niger) and its connection to ECOWAS network through the interconnection Niger-Nigeria-Benin-Burkina Faso (North Core project)

Characteristic of generating unit:

Salkadamna – 200 MW

Estimated cost: 573 M$

Characteristic of the linked transmission project:

225kV line between Salkadamna (Niger) and Niamey (Niger) allowing the connection of Salkadmna plant to ECOWAS network, either to a derivation of North Core (in Dosso, Niger), either to Niamey (Niger).

Length of the line: 190 km

- 225kV sub-station in Salkadamna (to be built)
- 225kV sub-station in Niamey (Commissioning in the frame of North Core project)

Estimated cost: 72 M$

Total cost of the project:

645 M$

Foreseen date of commissioning:

2019-2021

Comments:

Possibility to increase the capacity of the site at more long time

Progress of studies:

Identification status

5.2.2. Investment stages

In this section, the projects are classified into different stages using the following criteria:

- The decided projects have not been questioned during the study. They will be commissioned in the short to medium-term and are classified in a specific category.
- Other projects were spread between phases 1, 2 and 3 according to
  - The progress of related studies;
  - Their economic returns over the study period;
  - The interactions between projects: Some projects require the construction of other structures before they can be commissioned;
  - Geographical aspects: In order to maintain flexibility in the plan, each stage presents projects that are independent of each other and located in different regions of West Africa.

The implementation of this master plan should follow the following schedule to ensure the load supply throughout the region:

- **Phase 1**: Commissioning in the period 2017-2019
- **Phase 2**: Commissioning between 2019 and 2021
- **Phase 3**: Commissioning at long-term (2021-2023)

The stages were balanced to share the amounts of investment over the study period.

Figure 64 shows the projects distribution among the different stages. Interactions are highlighted with arrows showing the interests of some projects in other projects.

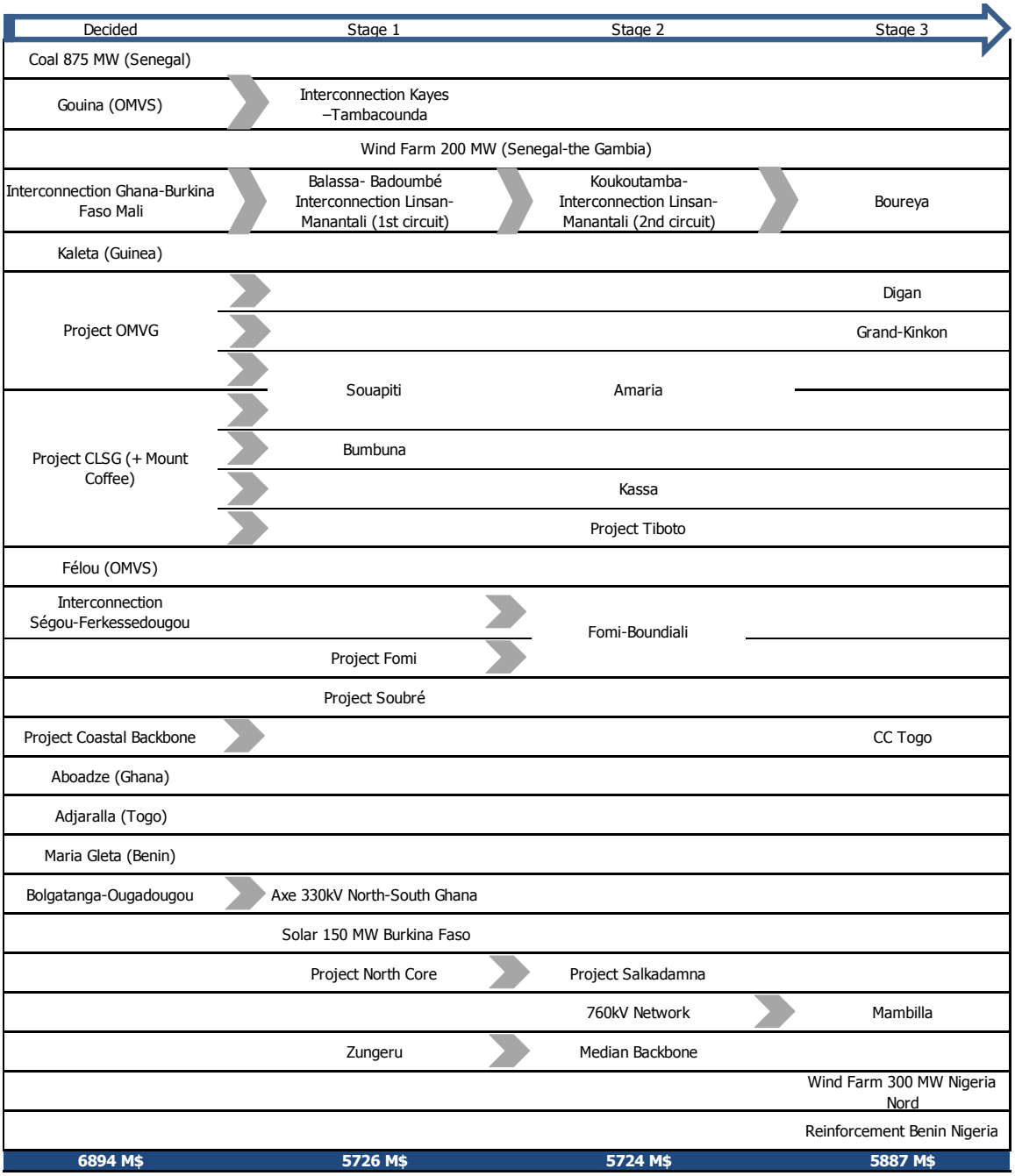


Figure 64: Classification of projects and presentation of interactions

It is also of utmost importance to emphasize the impact of the development of thermal generation in Nigeria on the regional Master Plan. Indeed Nigeria has an important plan for developing thermal generation in the short term, based on gas turbines. It is strongly recommended to complete the already decided gas turbines by steam turbines to form combined cycles that would be operated as base generation allowing the reduction of generation costs and securing the energy supply. This development of thermal generation in Nigeria should be closely followed and fully supported by the WAPP.

To these priority investments must be added the necessary investments to develop a structure to operate the interconnected systems. This supposes developing appropriate control centres and telecommunication systems to operate the interconnected system in an optimal way. At this condition only the WAPP will get the expected benefits of the regional interconnections and in particular the synergies between the national production systems.

6. CLEAN ENERGY AND RENEWABLES IN THE MASTER PLAN

This chapter highlights the environmental improvements brought by this master plan compared to the present situation for energy production in West Africa. It also estimates the CO_2 emission reduction in the region, in order to help the projects benefit from the existing financing mechanisms that reward environmental respect.

The electrical generation will evolve towards an energetic mix that integrates, more and more, clean or cleaner energy sources, and the following points must be noted:

1. The development of the region aims at interconnecting the isolated country and/or zones. These isolated areas presently produce their electricity mainly using diesel groups, whose efficiency and ecologic impact can only improve when using other technologies such as hydro and natural gas.
2. Thanks to these interconnections, production synergies are possible between countries, allowing to better valorize the resources and to build projects that would be too big for only one country. These synergies are also synonyms of better efficiency.
3. In this study, the reference scenario of development for the region shows that in 2025, the forecasts reach 30% of hydroelectricity and 60% of electricity produced from natural gas (gas turbine or combined cycle). The remaining 10% are produced from other sources such as coal or diesel, but also from renewable.

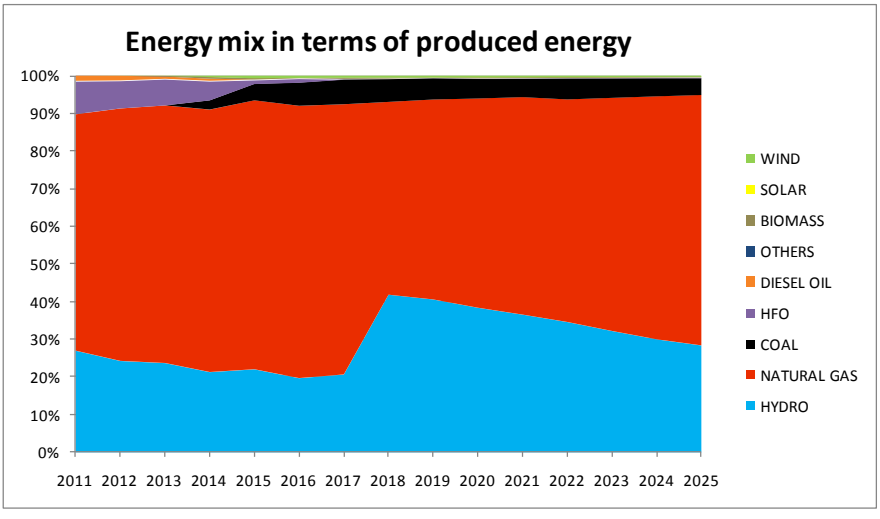


Figure 65 – Energy mix for West Africa (reference scenario)

About renewable energies, the list of regional priority projects includes large wind and solar projects. These projects have a regional vocation, but it does not prevent the states from undertaking their own voluntary policies towards renewable energies. A variant of the reference scenario for which a 10% objective of renewables (in installed capacity for 2020) is imposed was studied. This variant shows the following evolution of the energy mix.

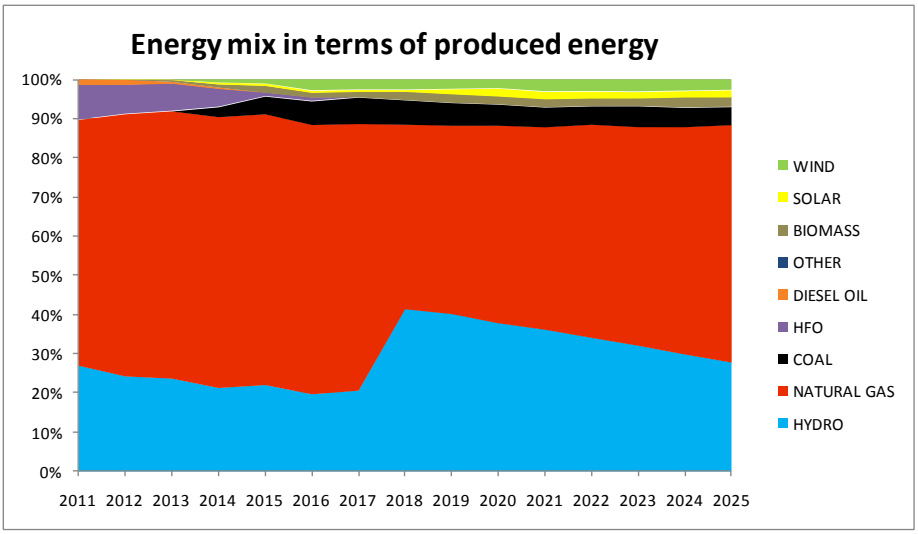


Figure 66 - Energy mix for West Africa (renewable policy scenario)

To facilitate the implementation of ecologic projects, the Kyoto protocol proposes to label the projects as CDM (Clean Development Mechanism) to benefit from financing helps. For that, the project must be presented describing the reductions in CO_2 emissions. A primary calculation of CO_2 emission credits (Certified Emission reduction – CER), expressed in tCO_2, for hydro/wind/solar projects was carried out, allowing the evaluation of additional gains that could result from the CDM of the Kyoto protocol. The following table lists the CER estimate for each generation project of the priority list.

For instance, the Felou project in Mali is already registered as CDM project in 2010. For the other projects mentioned in the table, a detailed electability analysis will be necessary to confirm the CDM feasibility.

Projects	Type	Country	Available power [MW]	Annual generation [GWh]	Status	tCO_2
Félou (OMVS)	Hydro	Mali	62.3	324.2	Decided	188 285
Mount Coffee	Hydro	Liberia	66	435.0	Decided	253 257
Gouina (OMVS)	Hydro	Mali	140	589.0	Decided	342 916
Adjaralla	Hydro	Togo / Benin	147	366.0	Decided	256 200
Sambangalou (OMVG)	Hydro	Senegal / Guinea	128	402.0	Decided	233 595
Grand Kinkon	Hydro	Guinea	291	735.0	Candidate	427 468
Balassa (OMVS)	Hydro	Guinea	181	470.0	Candidate	273 185
Koukoutamba (OMVS)	Hydro	Guinea	281	858.0	Candidate	499 078
Kassa B	Hydro	Guinea / Sierra Leone	135	528.0	Candidate	306 952
Tiboto	Hydro	Liberia / Côte d'Ivoire	225	1 200.0	Candidate	698 191
Soubré	Hydro	Côte d'Ivoire	270	1 116.0	Candidate	649 286
Zungeru	Hydro	Nigeria	700	3 019.0	Candidate	2 052 920
Mambilla	Hydro	Nigeria	2 600	11 214.0	Candidate	7 625 520
Souapiti	Hydro	Guinea	515	2 518.0	Candidate	1 465 530
Amaria	Hydro	Guinea	300	1 500.0	Candidate	872 851
Boureya (OMVS)	Hydro	Guinea	160	717.0	Candidate	430 200
Fomi	Hydro	Guinea	90	374.0	Candidate	224 400
Digan	Hydro	Guinea	93.3	242.0	Candidate	145 200
Bumbuna 2 + Yiben	Hydro	Sierra Leone	400	1 560.0	Candidate	907 140
Wind farm 200 MW	Wind	Senegal / Gambia	200	518.0	Candidate	363 636
Wind farm 300 MW	Wind	Nigeria	300	1 180.0	Candidate	802 400
Solar PV 150 MW	Solar	Burkina Faso	150	300.0	Candidate	210 000
Solar PV 150 MW	Solar	Mali	150	300.0	Candidate	165 000
TOTAL					19 393 210	

The CER price (tCO_2) is presently low because of the price fall of the emissions quotas in Europe: 7 to 8.5 €/tCO_2. It must be noted that CER coming from projects registered at the UNFCCC (United Nation Framework Convention on Climate Change) after the 1st of January 2013 and implemented in Least Developed Countries (LDC) can obtain higher prices because these CER will still be accepted by the European Commission in its exchange system for emission quotas. It concerns Benin, Burkina Faso, Guinea, Liberia, Mali, Mauritania, Niger, Senegal, Sierra Leone et Togo.

Also, the following countries already have CDM projects registered: Mali, Senegal, Ivory Coast and Liberia. It can therefore be expected that there is a sufficient administrative framework for the management of a future CDM project. Oppositely, the following countries do not have any CDM projects known, not even in the pipeline, and a more difficult administrative development must be expected: Guinea, Niger and Burkina Faso.

CHAPTER 3: FINANCIAL EVALUATION

APPENDIX 3.1: PAST FINANCIAL PERFORMANCE OF SELECTED UTILITIES

VRA FINANCIAL SUMMARY	2009	2008	2007
Average Net Fixed Assets (A)	1,461,670	1,320,241	1,180,683
Net Income Before Interest & Taxes (B)	7,527	(57,793)	(198,396)
Net Income After Taxes (C)	(51,305)	81,690	(27,852)
Net Cash Flow	39,897	79,114	21,835
Cumulative Cash Balance	39,897	79,114	21,835
Current Assets (D)	486,295	415,751	219,071
Current Liabilities (E)	326,747	268,118	193,549
Interest Payment (F)	20,565	7,537	15,287
Principal Repayment (G)	3,043	5,834	1,838
G/(1 - Tax Rate) (H)	3,901	7,479	2,356
Total Debt Service Burden (F+H)	24,466	15,017	17,643
FINANCIAL RATIOS			
Return on Average Net Fixed Assets(B/A)	**0.51%**	**-4.38%**	**-16.80%**
Current ratio (D/E)	**1.49**	**1.55**	**1.13**
Debt Service Cover Ratio (B/(F+H))	**0.31**	**(3.85)**	**(11.24)**
Days Receivables	**254**	**240**	**176**

CEB FINANCIAL SUMMARY			
	2009	**2008**	**2007**
Average Net Fixed Assets (A)	222,969,915	210,996,521	200,884,373
Net Income Before Interest & Taxes (B)	9,660,052	3,803,781	(6,723,867)
Net Income After Taxes (C)	9,660,052	3,803,781	(6,723,867)
Net Cash Flow	-	-	-
Cumulative Cash Balance	-	-	-
Current Assets (D)	164,003,403	108,228,200	101,871,256
Current Liabilities (E)	113,058,580	40,778,535	35,443,459
Interest Payment (F)	21,123,468	10,254,578	10,503,909
Principal Repayment (G)	-	-	-
G/(1 - Tax Rate) (H)	-	-	-
Total Debt Service Burden (F+H)	21,123,468	10,254,578	10,503,909
Return on Average Net Fixed Assets(B/A)	**4.3%**	**1.8%**	**-3.3%**
Current ratio (D/E)	**1.45**	**2.65**	**2.87**
Debt Service Cover Ratio (B/(F+H))	**0.46**	**0.37**	**(0.64)**
Days Receivables	**298**	**201**	**206**

SONABEL FINANCIAL SUMMARY			
	2009	2008	2007
Average Net Fixed Assets (A)	360,390,472	396,062,142	448,722,018
Net Income Before Interest & Taxes (B)	12,025,972	3,541,622	4,375,229
Net Income After Taxes (C)	7,423,451	1,478,660	2,061,418
Net Cash Flow	32,025,208	27,108,478	29,810,463
Cumulative Cash Balance			
Current Assets (D)	129,046,263	152,184,556	145,331,125
Current Liabilities (E)	47,269,027	63,866,431	73,796,211
Interest Payment (F)	4,484,588	4,478,915	4,786,546
Principal Repayment (G)	9,661,689	4,496,283	6,171,770
G/(1 - Tax Rate) (H)	13,802,413	6,423,261	8,816,814
Total Debt Service Burden (F+H)	18,287,001	10,902,176	13,603,361
Return on Average Net Fixed Assets(B/A)	**3.3%**	**0.9%**	**1.0%**
Current ratio (D/E)	**2.73**	**2.38**	**1.97**
Debt Service Cover Ratio (B/(F+H))	**0.66**	**0.32**	**0.32**
Days Receivables	**132**	**134**	**122**

SENELEC FINANCIAL SUMMARY				
	2010	2009	2008	2007
Average Net Fixed Assets (A)	**560,996,265**	**549,521,677**	**501,360,966**	**1,169,067,071**
Net Income Before Interest & Taxes (B)	(127,946,885)	13,536,956	(21,534,868)	(20,247,593)
Net Income After Taxes (C)	(127,946,885)	13,536,956	(21,534,868)	(20,247,593)
Net Cash Flow	-	-	-	-
Cumulative Cash Balance	42,175,359	74,692,468	95,997,539	69,390,336
Current Assets (D)	535,372,739	493,501,865	466,567,888	318,516,351
Current Liabilities (E)	549,992,089	433,472,865	419,880,909	313,647,058
Interest Payment (F)	14,898,968	13,969,898	12,973,547	10,803,485
Principal Repayment (G)				
G/(1 - Tax Rate) (H)				
Total Debt Service Burden (F+H)				
Return on Average Net Fixed Assets(B/A)	**-22.8%**	**2.5%**	**-4.3%**	**-1.7%**
Current ratio (D/E)	**0.97**	**1.14**	**1.11**	**1.02**
Debt Service Cover Ratio (B/(F+H))	**(8.59)**	**0.97**	**(1.66)**	**(1.87)**
Days Receivables	**271**	**231**	**207**	**173**

NIGELEC FINANCIAL SUMMARY

	2009	2008	2007
Average Net Fixed Assets (A)	**165,890**	**78,694**	**-**
Net Income Before Interest & Taxes (B)	4,819	15,512	-
Net Income After Taxes (C)	4,819	15,512	-
Net Cash Flow	-	-	-
Cumulative Cash Balance	-	-	-
Current Assets (D)	74,801	77,399	-
Current Liabilities (E)	82,709	81,888	-
Interest Payment (F)	5,344	5,767	-
Principal Repayment (G)			
G/(1 - Tax Rate) (H)			
Total Debt Service Burden (F+H)			
Return on Average Net Fixed Assets(B/A)	**2.9%**	**19.7%**	
Current ratio (D/E)	**0.90**	**0.95**	
Debt Service Cover Ratio (B/(F+H))	**0.90**	**2.69**	
Days Receivables	**162**	**197**	

FINANCIAL SUMMARY : E D M - SA (US$)			
	2009	2008	2007
Average Net Fixed Assets (A)	**474,356,613**	**468,758,082**	**506,993,432**
Net Income Before Interest & Taxes (B)	735,365	(10,687,178)	(13,205,140)
Net Income After Taxes (C)	(853,278)	(12,220,522)	(14,608,061)
Net Cash Flow	-	-	-
Cumulative Cash Balance	5,280,377	6,193,651	11,299,943
Current Assets (D)	117,513,944	110,546,753	108,133,593
Current Liabilities (E)	115,618,771	111,565,586	117,126,774
Interest Payment (F)	6,827,477	6,252,170	6,016,540
Principal Repayment (G)			
G/(1 - Tax Rate) (H)			
Total Debt Service Burden (F+H)			
Return on Average Net Fixed Assets(B/A)	**0.2%**	**-2.3%**	**-2.6%**
Current ratio (D/E)	**1.02**	**0.99**	**0.92**
Debt Service Cover Ratio (B/(F+H))	**0.11**	**(1.71)**	**(2.19)**
Days Receivables	**139**	**143**	**137**

FINANCIAL SUMMARY : E D G (US$)			
	2009	2008	2007
Average Net Fixed Assets (A)	**780,891,572**	**810,965,039**	**799,226,543**
Net Income Before Interest & Taxes (B)	(11,434,469)	(20,608,449)	(32,926,313)
Net Income After Taxes (C)	(7,914,402)	(20,820,172)	(32,782,044)
Net Cash Flow	-	-	-
Cumulative Cash Balance	41,237,096	78,117,469	72,193,463
Current Assets (D)	641,718,683	499,706,930	356,976,738
Current Liabilities (E)	515,973,705	389,788,561	276,109,891
Interest Payment (F)	15,631,871	9,847,379	7,406,846
Principal Repayment (G)			
G/(1 - Tax Rate) (H)			
Total Debt Service Burden (F+H)			
Return on Average Net Fixed Assets(B/A)	**-1.5%**	**-2.5%**	**-4.1%**
Current ratio (D/E)	**1.24**	**1.28**	**1.29**
Debt Service Cover Ratio (B/(F+H))	**(0.73)**	**(2.09)**	**(4.45)**
Days Receivables	**346**	**307**	**346**

SUMMARY OF FINANCIAL RATIOS - ESKOM				
	2010	2009	2008	2007
Return on Average Net Fixed Assets (%)	1.63	(5.29)	(0.11)	4.77
Current ratio	0.91	0.78	0.85	0.67
Debt Service Cover Ratio	2.53	0.75	0.68	11.43
Days Receivables (Average debtor days for Distribution)	22	20.8	19.5	19.5
Average debtor days for Transmission	16.1	18.1	16.5	–

SUMMARY OF FINANCIAL RATIOS - KEGENCO				
	2010	2009	2008	2007
Return on Average Net Fixed Assets (%)	2.36	4.92	3.35	7.00
Current ratio	4.68	2.17	1.40	2.00
Debt Service Cover Ratio	4.50	3.90	4.99	5.40
Days Receivables	**528**	**808**	**779**	**707**

APPENDIX 3.2: COMPUTATION OF TRANSMISSION SERVICE CHARGE

DETERMINATION OF POSTAGE STAMP TARIFFS
(DETERMINATION DU TARIF TIMBRE-POSTE)

YEAR *(ANNEE)*	Imports *(Importations)*	Investment Cost (Coût d'Investissement)	O&M & M&A *(E&M & G&A)*	Losses *(Pertes)*	Total Cost *(Total Coût)*	Total Benefit *(Total Profit)*	Net Cash flow *(Flux de Trésorerie)*
2011	**3,727**	665.0			**665.0**	63.02	-601.93
2012	**6,663**	673.3			**673.3**	112.67	-560.58
2013	**6,557**	737.6			**737.6**	110.88	-626.67
2014	**9,843**	392.0			**392.0**	166.44	-225.51
2015	**13,910**	233.0			**232.95**	235.21	2.26
2016	**14,257**	103.4			**103.35**	241.08	137.73
2017	**15,108**		42.06	49.92	**91.98**	255.47	163.49
2018	**18,447**		42.06	60.95	**103.01**	311.93	208.92
2019	**20,388**		42.06	67.36	**109.42**	344.75	235.33
2020	**21,060**		42.06	69.58	**111.64**	356.12	244.48
2021	**20,581**		42.06	68.00	**110.06**	348.02	237.96
2022	**20,677**		42.06	68.32	**110.38**	349.64	239.27
2023	**20,483**		42.06	67.67	**109.73**	346.36	236.63
2024	**20,752**		42.06	68.56	**110.62**	350.91	240.29
2025	**21,374**		42.06	70.62	**112.68**	361.44	248.76
2026	**22,015**		42.06	72.74	**114.80**	372.28	257.48
2027	**22,676**		42.06	74.92	**116.98**	383.45	266.47
2028	**23,356**		42.06	77.17	**119.23**	394.95	275.72
2029	**24,057**		42.06	79.48	**121.54**	406.80	285.26
2030	**24,778**		42.06	81.87	**123.93**	419.00	295.08
2031	**25,522**		42.06	84.32	**126.38**	431.57	305.19
2032	**26,288**		42.06	86.85	**128.91**	444.52	315.61
2033	**27,076**		42.06	89.46	**131.52**	457.86	326.34
2034	**27,888**		42.06	92.14	**134.20**	471.59	337.39
2035	**28,725**		42.06	94.91	**136.97**	485.74	348.77
2036	**29,587**		42.06	97.75	**139.81**	500.31	360.50
2037	**30,474**		42.06	100.69	**142.75**	515.32	372.57
2038	**31,389**		42.06	103.71	**145.77**	530.78	385.01
2039	**32,330**		42.06	106.82	**148.88**	546.71	397.83
2040	**33,300**		42.06	110.02	**152.08**	563.11	411.02
2041	**34,299**		42.06	113.32	**155.38**	580.00	424.62
2042	**35,328**		42.06	116.72	**158.78**	597.40	438.62
2043	**36,388**		42.06	120.23	**162.29**	615.32	453.04
2044	**37,480**		42.06	123.83	**165.89**	633.78	467.89
2045	**38,604**		42.06	127.55	**169.61**	652.80	483.19
2046	**39,762**		42.06	131.37	**173.43**	672.38	498.94
2047	**40,955**		42.06	135.32	**177.38**	692.55	515.17
2048	**42,184**		42.06	139.38	**181.44**	713.33	531.89
2049	**43,449**		42.06	143.56	**185.62**	734.73	549.11
2050	**44,753**		42.06	147.86	**189.92**	756.77	566.85
2051	**46,095**		42.06	152.30	**194.36**	779.47	585.11
2052	**47,478**		42.06	156.87	**198.93**	802.86	603.93
2053	**48,903**		42.06	161.57	**203.63**	826.94	623.31
2054	**50,370**		42.06	166.42	**208.48**	851.75	643.27
2055	**51,881**		42.06	171.41	**213.47**	877.30	663.83
2056	**53,437**		42.06	176.56	**218.62**	903.62	685.00
2057	**55,040**		42.06	181.85	**223.91**	930.73	706.82
2058	**56,691**		42.06	187.31	**229.37**	958.65	729.28
2059	**58,392**		42.06	192.93	**234.99**	987.41	752.42
2060	**60,144**		42.06	198.72	**240.78**	1,017.03	776.26
2061	**61,948**		42.06	204.68	**246.74**	1,047.54	800.81
TOTALS	**1,626,866**	**2,804**	**1,893**	**5,194**	**9,890**	**27,510**	**17,620**
PV (VA)	**168,899**	**2,186**	**415**	**771**	**2,855**	**2,856**	**0**
Computed Postage Stamp TSC *(FSTE calculé suivant le timbre-poste)*				=	**0.0169**		

APPENDIX 3.3: PRO FORMA FINANCIAL STATEMENTS OF SPCS

	ENERGY IMPORTS (GWh)														
Guinea - Mali SPC	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Guinea	1,232	1,585	2,297	-	-	-	-	-	1,003	1,958	1,335	779	244	-	132
Mali	-	-	-	136	797	1,545	1,154	928	1,016	1,171	1,331	1,449	1,640	1,831	2,007
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**1,232**	**1,585**	**2,297**	**136**	**797**	**1,545**	**1,154**	**928**	**2,019**	**3,129**	**2,666**	**2,228**	**1,884**	**1,831**	**2,139**
	Transmission Service Charge, TSC (*Frais du Service de Transport d'Energie, FSTE) - US$/kWh*														
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Guinea	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169
Mali	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169
	Revenue *(Recettes)* - US$million														
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Guinea	20.82	26.79	38.82	-	-	-	-	-	16.95	33.09	22.56	13.17	4.12	-	2.23
Mali	-	-	-	2.30	13.47	26.11	19.50	15.68	17.17	19.79	22.49	24.49	27.72	30.94	33.92
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	20.82	26.79	38.82	2.30	13.47	26.11	19.50	15.68	34.12	52.88	45.06	37.65	31.84	30.94	36.15

	Income Statement *(Etat des Recettes)* - US$ million														
Guinea - Mali SPC	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
TOTAL REVENUE	20.82	26.79	38.82	2.30	13.47	26.11	19.50	15.68	34.12	52.88	45.06	37.65	31.84	30.94	36.15
COSTS															
Operating and Maintenance - O&M					4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Management and Administration - M&A					0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Environmental							-	-	-	-	-	-	-	-	-
Depreciation	-	-	-	-	-	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
Total Operating Costs	-	-	-	-	**5.2**	**16.0**	**16.0**	**16.0**	**16.0**	**16.0**	**16.0**	**16.0**	**16.0**	**16.0**	**16.0**
Operating Income Before Interest	20.8	26.8	38.8	2.3	8.2	10.2	3.6	(0.3)	18.2	36.9	29.1	21.7	15.9	15.0	20.2
Loan Interest	-	-	-	-	12.8	11.8	10.8	9.6	8.4	7.2	5.9	4.5	3.1	1.6	-
Net Income Before Tax	20.8	26.8	38.8	2.3	(4.6)	(1.7)	(7.2)	(9.9)	9.7	29.7	23.2	17.2	12.8	13.4	20.2
Income Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Income After Tax	20.8	26.8	38.8	2.3	(4.6)	(1.7)	(7.2)	(9.9)	9.7	29.7	23.2	17.2	12.8	13.4	20.2
Dividend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings	20.8	26.8	38.8	2.3	(4.6)	(1.7)	(7.2)	(9.9)	9.7	29.7	23.2	17.2	12.8	13.4	20.2
Cumulative Earnings Retained	20.8	47.6	86.4	88.7	84.1	82.5	75.2	65.4	75.1	104.8	128.0	145.2	158.0	171.4	191.6
	CASHFLOW *(Flux de Trésorerie)* - US$ million														
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
INFLOWS															
Net Income After Tax	20.8	26.8	38.8	2.3	(4.6)	(1.7)	(7.2)	(9.9)	9.7	29.7	23.2	17.2	12.8	13.4	20.2
Depreciation	-	-	-	-	-	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7
Loan drawdown & IDC	55.3	48.0	73.2	44.6	35.8	-	-								
Equity drawdown	22.9	18.3	27.5	13.7	9.2	-									
Total Inflows	99.0	93.1	139.5	60.6	40.4	9.1	3.5	0.8	20.4	40.4	33.9	27.9	23.5	24.1	30.9
OUTFLOWS															
Capital Investments	78.2	66.3	100.7	58.3	45.0	-									
Loan Repayment	-	-	-	-	20.4	21.5	22.5	23.6	24.8	26.1	27.4	28.7	30.2	31.7	-
Dividend Paid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Outflows	78.2	66.3	100.7	58.3	65.4	21.5	22.5	23.6	24.8	26.1	27.4	28.7	30.2	31.7	-
NET CASHFLOWS	20.8	26.8	38.8	2.3	(25.0)	(12.4)	(19.0)	(22.8)	(4.4)	14.4	6.6	(0.9)	(6.7)	(7.6)	30.9
Cumulative Cash Balance	20.8	47.6	86.4	88.7	63.7	51.3	32.3	9.5	5.1	19.5	26.0	25.2	18.5	10.9	41.9

BALANCE SHEET *(Bilan)* - *US$* million															
Guinea - Mali SPC	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Net Fixed Assets	-	-	-	-	-	337.7	327.0	316.3	305.6	294.8	284.1	273.4	262.7	251.9	241.2
Capital Works In Progress	78.2	144.5	245.1	303.5	348.5	-	-	-	-	-	-	-	-	-	-
Current Assets															
Cash Balance	20.8	47.6	86.4	88.7	63.7	51.3	32.3	9.5	5.1	19.5	26.0	25.2	18.5	10.9	41.9
Accounts Receivable															

Inventory															
Total Current Assets	20.8	47.6	86.4	88.7	63.7	51.3	32.3	9.5	5.1	19.5	26.0	25.2	18.5	10.9	41.9
TOTAL ASSETS	**99.0**	**192.1**	**331.6**	**392.2**	**412.2**	**389.0**	**359.3**	**325.8**	**310.7**	**314.3**	**310.1**	**298.6**	**281.2**	**262.9**	**283.1**
Current Liabilities															
Accounts Payable															
Current Portion of Long Term Loans	-	-	-	20.4	21.5	22.5	23.6	24.8	26.1	27.4	28.7	30.2	31.7	-	-
Total Current Liabilities	**-**	**-**	**-**	**20.4**	**21.5**	**22.5**	**23.6**	**24.8**	**26.1**	**27.4**	**28.7**	**30.2**	**31.7**	**-**	**-**
Financing															
Retained Earnings	20.8	47.6	86.4	88.7	84.1	82.5	75.2	65.4	75.1	104.8	128.0	145.2	158.0	171.4	191.6
Long Term Loans	55.3	103.3	176.5	200.7	215.1	192.6	168.9	144.1	118.0	90.6	61.9	31.7	-	-	-
Equity	22.9	41.2	68.6	82.4	91.5	91.5	91.5	91.5	91.5	91.5	91.5	91.5	91.5	91.5	91.5
TOTAL LIABILITIES & EQUITY	**99.0**	**192.1**	**331.6**	**392.2**	**412.2**	**389.0**	**359.3**	**325.8**	**310.7**	**314.3**	**310.1**	**298.6**	**281.2**	**262.9**	**283.1**
FINANCIAL SUMMARY (Récapitulatif Financier) @ 0% tax															
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Average Net Fixed Assets (A)	-	-	-	-	-	343.1	332.4	321.7	310.9	300.2	289.5	278.8	268.0	257.3	246.6
Net Income Before Interest & Taxes (B)	20.8	26.8	38.8	2.3	8.2	10.2	3.6	(0.3)	18.2	36.9	29.1	21.7	15.9	15.0	20.2
Net Income After Taxes ©	20.8	26.8	38.8	2.3	(4.6)	(1.7)	(7.2)	(9.9)	9.7	29.7	23.2	17.2	12.8	13.4	20.2
Net Cash Flow	20.8	26.8	38.8	2.3	(25.0)	(12.4)	(19.0)	(22.8)	(4.4)	14.4	6.6	(0.9)	(6.7)	(7.6)	30.9
Cummulative Cash Balance	20.8	47.6	86.4	88.7	63.7	51.3	32.3	9.5	5.1	19.5	26.0	25.2	18.5	10.9	41.9
Current Assets (D)	20.8	47.6	86.4	88.7	63.7	51.3	32.3	9.5	5.1	19.5	26.0	25.2	18.5	10.9	41.9
Current Liabilities (E)	-	-	-	20.4	21.5	22.5	23.6	24.8	26.1	27.4	28.7	30.2	31.7	-	-
Interest Payment (F)	-	-	-	-	12.8	11.8	10.8	9.6	8.4	7.2	5.9	4.5	3.1	1.6	-
Principal Repayment (G)	-	-	-	-	20.4	21.5	22.5	23.6	24.8	26.1	27.4	28.7	30.2	31.7	-
G/(1 - Tax Rate) (H)	-	-	-	-	20.4	21.5	22.5	23.6	24.8	26.1	27.4	28.7	30.2	31.7	-
Total Debt Service Burden (F+H)	-	-	-	-	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	33.3	-
Return on Average net Fixed Assets(B/A)					-	0.0	0.0	(0.0)	0.1	0.1	0.1	0.1	0.1	**5.1%**	
Current ratio (D/E)					3.0	2.3	1.4	0.4	0.2	0.7	0.9	0.8	0.6	**1.14**	
Debt Service Cover Ratio (B/(F+H))					0.2	0.3	0.1	(0.0)	0.5	1.1	0.9	0.7	0.5	**0.48**	
NPV (US$m)	**41.9**														

	ENERGY IMPORTS (GWh)														
COTE D'IVOIRE - LIBERIA SPC	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
LIBERIA	-	-	347	347	347	347	347	347	347	347	347	347	347	347	347
COTE d'IVOIRE	-	-	-	225	80	-	-	-	-	-	-	-	14	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	**-**	**-**	**347**	**572**	**427**	**347**	**347**	**347**	**347**	**347**	**347**	**347**	**361**	**347**	**347**
	Transmission Service Charge, TSC (*Frais du Service de Transport d'Energie, FSTE) - US$/kWh*														
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**

LIBERIA	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169
COTE d'IVOIRE	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169
	Revenue *(Recettes)* - US$ million														
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
LIBERIA	-	-	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87	5.87
COTE d'IVOIRE	-	-	-	3.80	1.35	-	-	-	-	-	-	-	0.24	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	5.87	9.67	7.22	5.87	5.87	5.87	5.87	5.87	5.87	5.87	6.10	5.87	5.87

	Income Statement *(Etat des Recettes)* - US$ million														
COTE D'IVOIRE - LIBERIA SPC	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
TOTAL REVENUE	-	-	5.87	9.67	7.22	5.87	5.87	5.87	5.87	5.87	5.87	5.87	6.10	5.87	5.87
COSTS															
Operating and Maintenance - O&M					1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Management and Administration - M&A					0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Environmental							-	-	-	-	-	-	-	-	-
Depreciation	-	-	-	-	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Total Operating Costs	-	-	-	-	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**
Operating Income Before Interest	-	-	5.9	9.7	2.1	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.7	0.7
Loan Interest	-	-	-	-	4.0	3.7	3.3	3.0	2.6	2.2	1.8	1.4	1.0	0.5	-
Net Income Before Tax	-	-	5.9	9.7	(1.9)	(3.0)	(2.6)	(2.3)	(1.9)	(1.5)	(1.1)	(0.7)	(0.0)	0.2	0.7
Income Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Income After Tax	-	-	5.9	9.7	(1.9)	(3.0)	(2.6)	(2.3)	(1.9)	(1.5)	(1.1)	(0.7)	(0.0)	0.2	0.7
Dividend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings	-	-	5.9	9.7	(1.9)	(3.0)	(2.6)	(2.3)	(1.9)	(1.5)	(1.1)	(0.7)	(0.0)	0.2	0.7
Cumulative Earnings Retained	-	-	5.9	15.5	13.6	10.6	8.0	5.7	3.8	2.3	1.1	0.4	0.4	0.6	1.3
	CASHFLOW *(Flux de Trésorerie)* - US$ million														
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
INFLOWS															
Net Income After Tax	-	-	5.9	9.7	(1.9)	(3.0)	(2.6)	(2.3)	(1.9)	(1.5)	(1.1)	(0.7)	(0.0)	0.2	0.7
Depreciation	-	-	-	-	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Loan drawdown & IDC	10.9	18.9	38.3	11.8	7.0	-	-								
Equity drawdown	4.5	7.5	15.0	3.0	3.0	-									
Total Inflows	15.4	26.4	59.1	24.4	11.6	0.5	0.9	1.2	1.6	2.0	2.4	2.8	3.5	3.7	4.2
OUTFLOWS															
Capital Investments	15.4	26.4	53.3	14.8	10.0	-									
Loan Repayment	-	-	-	-	6.3	6.7	7.0	7.3	7.7	8.1	8.5	8.9	9.4	9.8	-
Dividend Paid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Outflows	15.4	26.4	53.3	14.8	16.3	6.7	7.0	7.3	7.7	8.1	8.5	8.9	9.4	9.8	-
NET CASHFLOWS	-	-	5.9	9.7	(4.8)	(6.1)	(6.1)	(6.1)	(6.1)	(6.1)	(6.1)	(6.1)	(5.9)	(6.1)	4.2
Cumulative Cash Balance	-	-	5.9	15.5	10.8	4.7	(1.4)	(7.6)	(13.7)	(19.8)	(25.9)	(32.0)	(37.9)	(44.0)	(39.7)

BALANCE SHEET *(Bilan)* - *US$* million															
COTE D'IVOIRE - LIBERIA SPC	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**

Net Fixed Assets	-	-	-	-	106.2	102.7	99.2	95.7	92.2	88.7	85.1	81.6	78.1	74.6	71.1
Capital Works In Progress	15.4	41.8	95.0	109.8	-	-	-	-	-	-	-	-	-	-	-
Current Assets															
Cash Balance	-	-	5.9	15.5	10.8	4.7	(1.4)	(7.6)	(13.7)	(19.8)	(25.9)	(32.0)	(37.9)	(44.0)	(39.7)
Accounts Receivable															
Inventory															
Total Current Assets	-	-	5.9	15.5	10.8	4.7	(1.4)	(7.6)	(13.7)	(19.8)	(25.9)	(32.0)	(37.9)	(44.0)	(39.7)
TOTAL ASSETS	**15.4**	**41.8**	**100.9**	**125.3**	**117.0**	**107.4**	**97.8**	**88.1**	**78.5**	**68.9**	**59.3**	**49.6**	**40.2**	**30.6**	**31.3**
Current Liabilities															
Accounts Payable															
Current Portion of Long Term Loans	-	-	-	6.3	6.7	7.0	7.3	7.7	8.1	8.5	8.9	9.4	9.8	-	-
Total Current Liabilities	**-**	**-**	**-**	**6.3**	**6.7**	**7.0**	**7.3**	**7.7**	**8.1**	**8.5**	**8.9**	**9.4**	**9.8**	**-**	**-**
Financing															
Retained Earnings	-	-	5.9	15.5	13.6	10.6	8.0	5.7	3.8	2.3	1.1	0.4	0.4	0.6	1.3
Long Term Loans	10.9	29.8	68.0	73.4	73.8	66.8	59.4	51.7	43.6	35.1	26.2	16.8	7.0	7.0	7.0
Equity	4.5	12.0	27.0	30.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0
TOTAL LIABILITIES & EQUITY	**15.4**	**41.8**	**100.9**	**125.3**	**127.0**	**117.4**	**107.8**	**98.1**	**88.5**	**78.9**	**69.3**	**59.6**	**50.2**	**40.6**	**41.3**

FINANCIAL SUMMARY (Récapitulatif Financier) @ 0% tax

	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Average Net Fixed Assets (A)	-	-	-	-	108.0	104.5	101.0	97.4	93.9	90.4	86.9	83.4	79.9	76.3	72.8
Net Income Before Interest & Taxes (B)	-	-	5.9	9.7	2.1	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.7	0.7
Net Income After Taxes ©	-	-	5.9	9.7	(1.9)	(3.0)	(2.6)	(2.3)	(1.9)	(1.5)	(1.1)	(0.7)	(0.0)	0.2	0.7
Net Cash Flow	-	-	5.9	9.7	(4.8)	(6.1)	(6.1)	(6.1)	(6.1)	(6.1)	(6.1)	(6.1)	(5.9)	(6.1)	4.2
Cumulative Cash Balance	-	-	5.9	15.5	10.8	4.7	(1.4)	(7.6)	(13.7)	(19.8)	(25.9)	(32.0)	(37.9)	(44.0)	(39.7)
Current Assets (D)	-	-	5.9	15.5	10.8	4.7	(1.4)	(7.6)	(13.7)	(19.8)	(25.9)	(32.0)	(37.9)	(44.0)	(39.7)
Current Liabilities (E)	-	-	-	6.3	6.7	7.0	7.3	7.7	8.1	8.5	8.9	9.4	9.8	-	-
Interest Payment (F)	-	-	-	-	4.0	3.7	3.3	3.0	2.6	2.2	1.8	1.4	1.0	0.5	-
Principal Repayment (G)	-	-	-	-	6.3	6.7	7.0	7.3	7.7	8.1	8.5	8.9	9.4	9.8	-
G/(1 - Tax Rate) (H)	-	-	-	-	6.3	6.7	7.0	7.3	7.7	8.1	8.5	8.9	9.4	9.8	-
Total Debt Service Burden (F+H)	-	-	-	-	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	-
Return on Average net Fixed Assets(B/A)					-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**0.7%**	
Current ratio (D/E)					1.6	0.7	(0.2)	(1.0)	(1.7)	(2.3)	(2.9)	(3.4)	(3.8)	**(1.45)**	
Debt Service Cover Ratio (B/(F+H))					0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	**0.09**	
NPV (US$m)	**(14.0)**														

	ENERGY IMPORTS														
NORTH CORE SPC	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
BENIN	1,055	1,314	1,745	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373	3,373
BURKINA FASO	-	1,110	1,196	1,357	1,462	1,603	1,724	1,915	2,126	2,282	2,415	2,612	2,763	2,945	3,103
NIGER	677	725	771	707	278	372	551	562	657	745	822	-	-	-	-
NIGERIA	-	-	-	-	-	-	-	-	-	-	-	3,170	2,978	2,844	1,842
TOTAL	**1,732**	**3,148**	**3,712**	**5,436**	**5,112**	**5,348**	**5,647**	**5,849**	**6,157**	**6,400**	**6,611**	**9,156**	**9,114**	**9,162**	**8,318**

**Transmission Service Charge, TSC (*Frais du Service de Transport d'Energie, FSTE) - US$/kWh*

	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
BENIN	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169
BURKINA FASO	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169
NIGER	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169
NIGERIA	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169	0.0169

TOTAL

	Revenue *(Recettes)* - US$million														
	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
BENIN	17.83	22.21	29.49	57.00	57.00	57.00	57.00	57.00	57.00	57.00	57.00	57.00	57.00	57.00	57.00
BURKINA FASO	-	18.75	20.21	22.92	24.70	27.08	29.13	32.36	35.94	38.57	40.82	44.15	46.70	49.77	52.44
NIGER	11.44	12.25	13.03	11.95	4.70	6.29	9.31	9.49	11.11	12.58	13.90	-	-	-	-
NIGERIA	-	-	-	-	-	-	-	-	-	-	-	53.58	50.33	48.06	31.13
TOTAL	29.27	53.21	62.73	91.87	86.40	90.38	95.44	98.85	104.05	108.15	111.72	154.73	154.02	154.84	140.57

Income Statement *(Etat des Recettes)* - US$ million

NORTH CORE SPC	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
TOTAL REVENUE	29.27	53.21	62.73	91.87	86.40	90.38	95.44	98.85	104.05	108.15	111.72	154.73	154.02	154.84	140.57
COSTS															
Operating and Maintenance - O&M					7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7	7.7
Management and Administration - M&A					1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Environmental							-	-	-	-	-	-	-	-	-
Depreciation	-	-	-	-	-	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Total Operating Costs	-	-	-	-	**9.2**	**28.2**	**28.2**	**28.2**	**28.2**	**28.2**	**28.2**	**28.2**	**28.2**	**28.2**	**28.2**
Operating Income Before Interest	29.3	53.2	62.7	91.9	77.2	62.2	67.2	70.6	75.8	79.9	83.5	126.5	125.8	126.6	112.4
Loan Interest	-	-	-	-	22.7	20.9	19.0	17.0	14.9	12.7	10.4	8.0	5.5	2.8	0.0
Net Income Before Tax	29.3	53.2	62.7	91.9	54.5	41.3	48.2	53.6	60.9	67.2	73.1	118.5	120.3	123.8	112.4
Income Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Income After Tax	29.3	53.2	62.7	91.9	54.5	41.3	48.2	53.6	60.9	67.2	73.1	118.5	120.3	123.8	112.4
Dividend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings	29.3	53.2	62.7	91.9	54.5	41.3	48.2	53.6	60.9	67.2	73.1	118.5	120.3	123.8	112.4
Cumulative Earnings Retained	29.3	82.5	145.2	237.1	291.6	332.8	381.1	434.7	495.6	562.8	635.9	754.4	874.8	998.6	1,110.9

CASHFLOW *(Flux de Trésorerie)* - US$ million

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
INFLOWS															
Net Income After Tax	29.3	53.2	62.7	91.9	54.5	41.3	48.2	53.6	60.9	67.2	73.1	118.5	120.3	123.8	112.4
Depreciation	-	-	-	-	-	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0
Loan drawdown & IDC	78.3	103.3	129.6	79.0	63.5	-	-								
Equity drawdown	32.4	40.5	48.6	24.3	16.2	-									
Total Inflows	140.0	197.0	240.9	195.1	134.1	60.3	67.2	72.6	79.9	86.2	92.1	137.5	139.3	142.8	131.3
OUTFLOWS															
Capital Investments	110.7	143.8	178.2	103.3	79.7	-									
Loan Repayment	-	-	-	-	36.1	37.9	39.8	41.7	43.8	46.0	48.3	50.7	53.3	55.9	(0.0)
Dividend Paid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Outflows	110.7	143.8	178.2	103.3	115.7	37.9	39.8	41.7	43.8	46.0	48.3	50.7	53.3	55.9	(0.0)
NET CASHFLOWS	29.3	53.2	62.7	91.9	18.4	22.4	27.5	30.9	36.1	40.2	43.7	86.8	86.0	86.9	131.3
Cumulative Cash Balance	29.3	82.5	145.2	237.1	255.5	277.9	305.4	336.2	372.3	412.5	456.2	543.0	629.0	715.9	847.2

BALANCE SHEET *(Bilan) - US$* million

NORTH CORE SPC	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025

Net Fixed Assets	-	-	-	-	-	596.6	577.6	558.6	539.6	520.7	501.7	482.7	463.7	444.7	425.7
Capital Works In Progress	110.7	254.5	432.7	536.0	615.6	-	-	-	-	-	-	-	-	-	-
Current Assets															
Cash Balance	29.3	82.5	145.2	237.1	255.5	277.9	305.4	336.2	372.3	412.5	456.2	543.0	629.0	715.9	847.2
Accounts Receivable															
Inventory															
Total Current Assets	29.3	82.5	145.2	237.1	255.5	277.9	305.4	336.2	372.3	412.5	456.2	543.0	629.0	715.9	847.2
TOTAL ASSETS	**140.0**	**337.0**	**577.9**	**773.0**	**871.1**	**874.5**	**883.0**	**894.9**	**912.0**	**933.1**	**957.9**	**1,025.7**	**1,092.7**	**1,160.6**	**1,272.9**
Current Liabilities															
Accounts Payable															
Current Portion of Long Term Loans	-	-	-	36.1	37.9	39.8	41.7	43.8	46.0	48.3	50.7	53.3	55.9	(0.0)	(0.0)
Total Current Liabilities	**-**	**-**	**-**	**36.1**	**37.9**	**39.8**	**41.7**	**43.8**	**46.0**	**48.3**	**50.7**	**53.3**	**55.9**	**(0.0)**	**(0.0)**
Financing															
Retained Earnings	29.3	82.5	145.2	237.1	291.6	332.8	381.1	434.7	495.6	562.8	635.9	754.4	874.8	998.6	1,110.9
Long Term Loans	78.3	181.6	311.2	354.1	379.7	339.9	298.2	254.3	208.3	160.0	109.2	55.9	0.0	0.0	0.0
Equity	32.4	72.9	121.5	145.8	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0	162.0
TOTAL LIABILITIES & EQUITY	**140.0**	**337.0**	**577.9**	**773.0**	**871.1**	**874.5**	**883.0**	**894.9**	**912.0**	**933.1**	**957.9**	**1,025.7**	**1,092.7**	**1,160.6**	**1,272.9**

FINANCIAL SUMMARY (Récapitulatif Financier) @ 0% tax

	2011	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
Average Net Fixed Assets (A)	-	-	-	-	-	606.1	587.1	568.1	549.1	530.2	511.2	492.2	473.2	454.2	435.2
Net Income Before Interest & Taxes (B)	29.3	53.2	62.7	91.9	77.2	62.2	67.2	70.6	75.8	79.9	83.5	126.5	125.8	126.6	112.4
Net Income After Taxes ©	29.3	53.2	62.7	91.9	54.5	41.3	48.2	53.6	60.9	67.2	73.1	118.5	120.3	123.8	112.4
Net Cash Flow	29.3	53.2	62.7	91.9	18.4	22.4	27.5	30.9	36.1	40.2	43.7	86.8	86.0	86.9	131.3
Cummulative Cash Balance	29.3	82.5	145.2	237.1	255.5	277.9	305.4	336.2	372.3	412.5	456.2	543.0	629.0	715.9	847.2
Current Assets (D)	29.3	82.5	145.2	237.1	255.5	277.9	305.4	336.2	372.3	412.5	456.2	543.0	629.0	715.9	847.2
Current Liabilities (E)	-	-	-	36.1	37.9	39.8	41.7	43.8	46.0	48.3	50.7	53.3	55.9	(0.0)	(0.0)
Interest Payment (F)	-	-	-	-	22.7	20.9	19.0	17.0	14.9	12.7	10.4	8.0	5.5	2.8	0.0
Principal Repayment (G)	-	-	-	-	36.1	37.9	39.8	41.7	43.8	46.0	48.3	50.7	53.3	55.9	(0.0)
G/(1 - Tax Rate) (H)	-	-	-	-	36.1	37.9	39.8	41.7	43.8	46.0	48.3	50.7	53.3	55.9	(0.0)
Total Debt Service Burden (F+H)	-	-	-	-	58.7	58.7	58.7	58.7	58.7	58.7	58.7	58.7	58.7	58.7	-
Return on Average net Fixed Assets(B/A)					0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	**16.5%**	
Current ratio (D/E)					6.7	7.0	7.3	7.7	8.1	8.5	9.0	10.2	11.2	**8.42**	
Debt Service Cover Ratio (B/(F+H))					1.3	1.1	1.1	1.2	1.3	1.4	1.4	2.2	2.1	**1.45**	
NPV (US$m)	**424.6**														

	2012	2017	2018	2019	2020	2021	2025	2026	2027	2028	2029	2030	2033	2034	2035
Annual Generation			717	717	717	717	717	717	717	717	717	717	717	717	717
TOTAL	**-**	**-**	**717**	**717**	**717**	**717**	**717**	**717**	**717**	**717**	**717**	**717**	**717**	**717**	**717**
	Bulk Generation Tariff, BGT *- US$/kWh*														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2033**	**2034**	**2035**
Annual BGT	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826
	Revenue *(Recettes)* - US$ million														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2033**	**2034**	**2035**
Annual Revenues	-	-	59.22	59.22	59.22	59.22	59.22	59.22	59.2242	59.2242	59.2242	59.2242	59.2242	59.2242	59.2242
TOTAL	-	-	59.22	59.22	59.22	59.22	59.22	59.22	59.22	59.22	59.22	59.22	59.22	59.22	59.22

GRAND KINKON HYDRO	Income Statement *(Etat des Recettes)* - US$million														
	2012	2017	2018	2019	2020	2021	2025	2026	2027	2028	2029	2030	2033	2034	2035
TOTAL REVENUE	-	-	59.22	59.22	59.22	59.22	59.22	59.22	59.22	59.22	59.22	59.22	59.22	59.22	59.22
COSTS															
Operating and Maintenance - O&M			1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Management and Administration - M&A			0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Environmental			-	-	-	-	-	-	0.00	0.00	0.00	0.00			
Depreciation	-	-	6.0	6.0	6.0	6.0	6.0	6.0	5.96	5.96	5.96	5.96	5.96	5.96	5.96
Total Operating Costs	-	-	**7.39**	**7.39**	**7.39**	**7.39**	**7.39**	**7.39**	**7.39**	**7.39**	**7.39**	**7.39**	**7.39**	**7.39**	**7.39**
Operating Income Before Interest	-	-	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8
Loan Interest	-		12.8	11.6	11.1	10.6	8.5	7.9	-	-	-	-	-	-	-
Net Income Before Tax	-		39.1	40.3	40.7	41.2	43.3	43.9	51.8	51.8	51.8	51.8	51.8	51.8	51.8
Income Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Income After Tax	-	-	39.1	40.3	40.7	41.2	43.3	43.9	51.8	51.8	51.8	51.8	51.8	51.8	51.8
Dividend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings	-	-	39.1	40.3	40.7	41.2	43.3	43.9	51.8	51.8	51.8	51.8	51.8	51.8	51.8
Cumulative Earnings Retained	-	-	39.1	79.3	120.0	161.2	331.2	375.1	426.9	478.7	530.6	582.4	737.9	789.7	841.6
	CASHFLOW *(Flux de Trésorerie)* - US$ million														
	2012	2017	2018	2019	2020	2021	2025	2026	2027	2028	2029	2030	2033	2034	2035
INFLOWS															
Net Income After Tax	-	-	39.05	40.27	40.72	41.19	43.31	43.91	51.8	51.8	51.8	51.8	51.8	51.8	51.8
Depreciation	-	-	5.96	5.96	5.96	5.96	5.96	5.96	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Loan drawdown & IDC	21.6	35.0	-												
Equity drawdown	8.9	8.9													
Total Inflows	30.5	44.0	45.0	46.2	46.7	47.1	49.3	49.9	57.8	57.8	57.8	57.8	57.8	57.8	57.8
OUTFLOWS															
Capital Investments	30.5	44.0													
Loan Repayment	-		7.7	8.1	8.5	8.9	10.9	11.4	12.0	12.6	13.2	13.9	-	-	-
Dividend Paid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Outflows	30.5	44.0	7.7	8.1	8.5	8.9	10.9	11.4	12.0	12.6	13.2	13.9	-	-	-
NET CASHFLOWS	-	-	37.3	38.1	38.2	38.2	38.4	38.5	45.8	45.2	44.6	43.9	57.8	57.8	57.8
Cumulative Cash Balance	-	-	37.3	75.4	113.6	151.8	305.1	343.5	389.3	434.5	479.1	523.0	666.5	724.3	782.1

GRAND KINKON HYDRO	BALANCE SHEET *(Bilan)* - US$ million														
	2012	2017	2018	2019	2020	2021	2025	2026	2027	2028	2029	2030	2033	2034	2035
Net Fixed Assets	-	-	339.0	333.0	327.1	321.1	297.3	291.3	285.3	279.4	273.4	267.5	249.6	243.6	237.7

Capital Works In Progress	30.5	344.9	-	-	-	-	-	-	-	-	-	-	-	-	-
Current Assets															
Cash Balance	-	-	37.3	75.4	113.6	151.8	305.1	343.5	389.3	434.5	479.1	523.0	666.5	724.3	782.1
Accounts Receivable															
Inventory															
Total Current Assets	**-**	**-**	**37.3**	**75.4**	**113.6**	**151.8**	**305.1**	**343.5**	**389.3**	**434.5**	**479.1**	**523.0**	**666.5**	**724.3**	**782.1**
TOTAL ASSETS	**30.5**	**344.9**	**376.3**	**408.4**	**440.6**	**472.9**	**602.3**	**634.8**	**674.6**	**713.9**	**752.5**	**790.5**	**916.1**	**967.9**	**1,019.7**
Current Liabilities															
Accounts Payable															
Current Portion of Long Term Loans	-		7.7	8.1	8.5	8.9	10.9	11.4	12.0	12.6	13.2	13.9	-	-	-
Total Current Liabilities	**-**	**-**	**7.7**	**8.1**	**8.5**	**8.9**	**10.9**	**11.4**	**12.0**	**12.6**	**13.2**	**13.9**	**-**	**-**	**-**
Financing															
Retained Earnings	-	-	39.1	79.3	120.0	161.2	331.2	375.1	426.9	478.7	530.6	582.4	737.9	789.7	841.6
Long Term Loans	21.6	255.5	240.1	231.6	222.7	213.3	170.9	158.9	146.3	133.2	119.3	104.8	88.8	88.8	88.8
Equity	8.9	89.4	89.4	89.4	89.4	89.4	89.4	89.4	89.4	89.4	89.4	89.4	89.4	89.4	89.4
TOTAL LIABILITIES & EQUITY	**30.5**	**344.9**	**376.3**	**408.4**	**440.6**	**472.9**	**602.3**	**634.8**	**674.6**	**713.9**	**752.5**	**790.5**	**916.1**	**967.9**	**1,019.7**

FINANCIAL SUMMARY (Récapitulatif Financier) @ 0% tax

	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2033**	**2034**	**2035**
Average Net Fixed Assets (A)	-	-	342.0	336.0	330.0	324.1	300.2	294.3	288.3	282.4	276.4	270.4	252.6	246.6	240.6
Net Income Before Interest & Taxes (B)	-	-	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8
Net Income After Taxes ©	-	-	39.1	40.3	40.7	41.2	43.3	43.9	51.8	51.8	51.8	51.8	51.8	51.8	51.8
Net Cash Flow	-	-	37.3	38.1	38.2	38.2	38.4	38.5	45.8	45.2	44.6	43.9	57.8	57.8	57.8
Cummulative Cash Balance	-	-	37.3	75.4	113.6	151.8	305.1	343.5	389.3	434.5	479.1	523.0	666.5	724.3	782.1
Current Assets (D)	-	-	37.3	75.4	113.6	151.8	305.1	343.5	389.3	434.5	479.1	523.0	666.5	724.3	782.1
Current Liabilities (E)	-	-	7.7	8.1	8.5	8.9	10.9	11.4	12.0	12.6	13.2	13.9	-	-	-
Interest Payment (F)	-	-	12.8	11.6	11.1	10.6	8.5	7.9	-	-	-	-	-	-	-
Principal Repayment (G)	-	-	7.7	8.1	8.5	8.9	10.9	11.4	12.0	12.6	13.2	13.9	-	-	-
G/(1 - Tax Rate) (H)	-	-	7.7	8.1	8.5	8.9	10.9	11.4	12.0	12.6	13.2	13.9	-	-	-
Total Debt Service Burden (F+H)	-	-	20.5	19.7	19.6	19.6	19.4	19.3	12.0	12.6	13.2	13.9	-	-	-
Return on Average net Fixed Assets(B/A)			15%	15%	16%	16%	17%	18%	18%	18%	19%	19%	**17%**		
Current ratio (D/E)			4.8	9.3	13.3	17.0	28.1	30.1	32.5	34.5	36.2	37.7	**26.1**		
Debt Service Cover Ratio (B/(F+H))			2.5	2.6	2.6	2.6	2.7	2.7	4.3	4.1	3.9	3.7	**3.1**		
NPV (US$m)	**170**														

	ENERGY GENERATION (GWh)														
KOUKOUTAMBA HYDRO	**2012**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2036**
Annual Generation			858	858	858	858	858	858	858	858	858	858	858	858	858
TOTAL	**-**	**-**	**858**	**858**	**858**	**858**	**858**	**858**	**858**	**858**	**858**	**858**	**858**	**858**	**858**
	Bulk Generation Tariff, BGT - *US$/kWh*														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2036**
Annual BGT	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826
	Revenue *(Recettes)* - US$ million														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2036**
Annual Revenues	-	-	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.8708	70.8708	70.8708	70.8708	70.8708
TOTAL	-	-	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.87

	Income Statement *(Etat des Recettes)* - US$million														
KOUKOUTAMBA HYDRO	**2012**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2036**
TOTAL REVENUE	-	-	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.87	70.87
COSTS															
Operating and Maintenance - O&M			1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Management and Administration - M&A			0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Environmental			-	-	-	-	-	-	-	-	0.00				
Depreciation	-	-	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.08	8.08	8.08	8.08	8.08
Total Operating Costs	-	**-**	**9.80**	**9.80**	**9.80**	**9.80**	**9.80**	**9.80**	**9.80**	**9.80**	**9.80**	**9.80**	**9.80**	**9.80**	**9.80**
Operating Income Before Interest	-	-	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1
Loan Interest	-		17.3	15.7	15.1	14.4	13.8	13.1	12.3	11.5	-	-	-	-	-
Net Income Before Tax	-		43.8	45.4	46.0	46.6	47.3	48.0	48.8	49.5	61.1	61.1	61.1	61.1	61.1
Income Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Income After Tax	-	-	43.8	45.4	46.0	46.6	47.3	48.0	48.8	49.5	61.1	61.1	61.1	61.1	61.1
Dividend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings	-	-	43.8	45.4	46.0	46.6	47.3	48.0	48.8	49.5	61.1	61.1	61.1	61.1	61.1
Cumulative Earnings Retained	-	-	43.8	89.2	135.2	181.8	229.1	277.2	325.9	375.4	670.1	731.2	792.2	853.3	1,036.5
	CASHFLOW *(Flux de Trésorerie)* - US$ million														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2036**
INFLOWS															
Net Income After Tax	-	-	43.75	45.40	46.01	46.65	47.32	48.02	48.76	49.53	61.1	61.1	61.1	61.1	61.1
Depreciation	-	-	8.08	8.08	8.08	8.08	8.08	8.08	8.08	8.08	8.1	8.1	8.1	8.1	8.1
Loan drawdown & IDC	29.3	47.5	-												
Equity drawdown	12.1	12.1													
Total Inflows	41.4	59.6	51.8	53.5	54.1	54.7	55.4	56.1	56.8	57.6	69.2	69.2	69.2	69.2	69.2
OUTFLOWS															
Capital Investments	41.4	59.6													
Loan Repayment	-		10.5	11.0	11.6	12.1	12.7	13.4	14.0	14.7	18.8	19.8	20.7	-	-
Dividend Paid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Outflows	41.4	59.6	10.5	11.0	11.6	12.1	12.7	13.4	14.0	14.7	18.8	19.8	20.7	-	-
NET CASHFLOWS	-	-	41.4	42.5	42.5	42.6	42.7	42.7	42.8	42.9	50.3	49.4	48.4	69.2	69.2
Cumulative Cash Balance	-	-	41.4	83.8	126.4	169.0	211.6	254.4	297.2	340.0	589.5	638.9	687.4	756.5	964.0

	BALANCE SHEET *(Bilan)* - *US$* million

KOUKOUTAMBA HYDRO															
	2012	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2031	2032	2033	2036
Net Fixed Assets	-	-	459.6	451.5	443.4	435.3	427.2	419.2	411.1	403.0	362.6	354.5	346.4	338.4	314.1
Capital Works In Progress	41.4	467.6	-	-	-	-	-	-	-	-	-	-	-	-	-
Current Assets															
Cash Balance	-	-	41.4	83.8	126.4	169.0	211.6	254.4	297.2	340.0	589.5	638.9	687.4	756.5	964.0
Accounts Receivable															
Inventory															
Total Current Assets	-	-	41.4	83.8	126.4	169.0	211.6	254.4	297.2	340.0	589.5	638.9	687.4	756.5	964.0
TOTAL ASSETS	41.4	467.6	500.9	535.3	569.8	604.3	638.9	673.5	708.2	743.0	952.1	993.4	1,033.8	1,094.9	1,278.1
Current Liabilities															
Accounts Payable															
Current Portion of Long Term Loans	-		10.5	11.0	11.6	12.1	12.7	13.4	14.0	14.7	18.8	19.8	20.7	-	-
Total Current Liabilities	-	-	10.5	11.0	11.6	12.1	12.7	13.4	14.0	14.7	18.8	19.8	20.7	-	-
Financing															
Retained Earnings	-	-	43.8	89.2	135.2	181.8	229.1	277.2	325.9	375.4	670.1	731.2	792.2	853.3	1,036.5
Long Term Loans	29.3	346.4	325.5	314.0	301.9	289.1	275.8	261.8	247.1	231.6	142.0	121.3	99.6	120.4	120.4
Equity	12.1	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2	121.2
TOTAL LIABILITIES & EQUITY	41.4	467.6	500.9	535.3	569.8	604.3	638.9	673.5	708.2	743.0	952.1	993.4	1,033.8	1,094.9	1,278.1

FINANCIAL SUMMARY (Récapitulatif Financier) @ 0% tax

	2012	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2031	2032	2033	2036
Average Net Fixed Assets (A)	-	-	463.6	455.5	447.4	439.4	431.3	423.2	415.1	407.0	366.6	358.6	350.5	342.4	318.2
Net Income Before Interest & Taxes (B)	-	-	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1
Net Income After Taxes ©	-	-	43.8	45.4	46.0	46.6	47.3	48.0	48.8	49.5	61.1	61.1	61.1	61.1	61.1
Net Cash Flow	-	-	41.4	42.5	42.5	42.6	42.7	42.7	42.8	42.9	50.3	49.4	48.4	69.2	69.2
Cummulative Cash Balance	-	-	41.4	83.8	126.4	169.0	211.6	254.4	297.2	340.0	589.5	638.9	687.4	756.5	964.0
Current Assets (D)	-	-	41.4	83.8	126.4	169.0	211.6	254.4	297.2	340.0	589.5	638.9	687.4	756.5	964.0
Current Liabilities (E)	-	-	10.5	11.0	11.6	12.1	12.7	13.4	14.0	14.7	18.8	19.8	20.7	-	-
Interest Payment (F)	-	-	17.3	15.7	15.1	14.4	13.8	13.1	12.3	11.5	-	-	-	-	-
Principal Repayment (G)	-	-	10.5	11.0	11.6	12.1	12.7	13.4	14.0	14.7	18.8	19.8	20.7	-	-
G/(1 - Tax Rate) (H)	-	-	10.5	11.0	11.6	12.1	12.7	13.4	14.0	14.7	18.8	19.8	20.7	-	-
Total Debt Service Burden (F+H)	-	-	27.8	26.7	26.6	26.6	26.5	26.4	26.4	26.3	18.8	19.8	20.7	-	-
Return on Average net Fixed Assets(B/A)			13%	13%	14%	14%	14%	14%	15%	15%	17%	17%	17%	**15%**	0.2
Current ratio (D/E)			3.9	7.6	10.9	13.9	16.6	19.0	21.2	23.1	31.3	32.3	33.1	**21.6**	#DIV/0!
Debt Service Cover Ratio (B/(F+H))			2.2	2.3	2.3	2.3	2.3	2.3	2.3	2.3	3.2	3.1	2.9	**2.7**	#DIV/0!
NPV (US$m)	191														

	ENERGY GENERATION (GWh)														
MAMBILLA HYDRO	2012	2017	2018	2019	2020	2021	2022	2024	2025	2030	2031	2032	2033	2034	2035
Annual Generation			11,214	11,214	11,214	11,214	11,214	11,214	11,214	11,214	11,214	11,214	11,214	11,214	11,214

TOTAL	-	-	11,214	11,214	11,214	11,214	11,214	11,214	11,214	11,214	11,214	11,214	11,214	11,214	11,214
	Bulk Generation Tariff, BGT - *US$/kWh*														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Annual BGT	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826
	Revenue *(Recettes)* - US$ million														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Annual Revenues	-	-	926.28	926.28	926.28	926.28	926.28	926.28	926.28	926.2764	926.2764	926.2764	926.2764	926.2764	926.276
TOTAL	-	-	926.28	926.28	926.28	926.28	926.28	926.28	926.28	926.28	926.28	926.28	926.28	926.28	926.28

	Income Statement *(Etat des Recettes)* - US$million														
MAMBILLA HYDRO	**2012**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
TOTAL REVENUE	-	-	926.28	926.28	926.28	926.28	926.28	926.28	926.28	926.28	926.28	926.28	926.28	926.28	926.28
COSTS															
Operating and Maintenance - O&M			16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8
Management and Administration - M&A			5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6	5.6
Environmental			-	-	-	-	-	-	-	0.00					
Depreciation	-	-	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.00	80.00	80.00	80.00	80.00	80.00
Total Operating Costs	-	**-**	**102.43**	**102.43**	**102.43**	**102.43**	**102.43**	**102.43**	**102.43**	**102.43**	**102.43**	**102.43**	**102.43**	**102.43**	**102.43**
Operating Income Before Interest	-	-	823.8	823.8	823.8	823.8	823.8	823.8	823.8	823.8	823.8	823.8	823.8	823.8	823.8
Loan Interest	-		171.5	155.1	149.1	142.8	136.2	122.0	114.3	-	-	-	-	-	-
Net Income Before Tax	-		652.3	668.7	674.7	681.0	687.6	701.9	709.5	823.8	823.8	823.8	823.8	823.8	823.8
Income Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Income After Tax	-	-	652.3	668.7	674.7	681.0	687.6	701.9	709.5	823.8	823.8	823.8	823.8	823.8	823.8
Dividend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings	-	-	652.3	668.7	674.7	681.0	687.6	701.9	709.5	823.8	823.8	823.8	823.8	823.8	823.8
Cumulative Earnings Retained	-	-	652.3	1,321.0	1,995.8	2,676.8	3,364.4	4,760.8	5,470.4	9,483.4	10,307.2	11,131.1	11,954.9	12,778.8	13,602.6
	CASHFLOW *(Flux de Trésorerie)* - US$ million														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
INFLOWS															
Net Income After Tax	-	-	652.35	668.70	674.70	681.01	687.63	701.88	709.54	823.8	823.8	823.8	823.8	823.8	823.8
Depreciation	-	-	80.00	80.00	80.00	80.00	80.00	80.00	80.00	80.0	80.0	80.0	80.0	80.0	80.0
Loan drawdown & IDC	290.0	470.0	-												
Equity drawdown	120.0	120.0													
Total Inflows	410.0	590.0	732.3	748.7	754.7	761.0	767.6	781.9	789.5	903.8	903.8	903.8	903.8	903.8	903.8
OUTFLOWS															
Capital Investments	410.0	590.0													
Loan Repayment	-		103.7	108.9	114.4	120.1	126.1	139.0	146.0	186.3	195.6	205.4	-	-	-
Dividend Paid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Outflows	410.0	590.0	103.7	108.9	114.4	120.1	126.1	139.0	146.0	186.3	195.6	205.4	-	-	-
NET CASHFLOWS	-	-	628.6	639.8	640.3	640.9	641.5	642.9	643.6	717.6	708.2	698.5	903.8	903.8	903.8
Cumulative Cash Balance	-	-	628.6	1,268.4	1,908.7	2,549.7	3,191.2	4,476.3	5,119.8	8,686.0	9,394.2	10,092.7	10,996.5	11,900.4	12,804.2

	BALANCE SHEET *(Bilan)* - *US$* million

MAMBILLA HYDRO	2012	2017	2018	2019	2020	2021	2022	2024	2025	2030	2031	2032	2033	2034	2035
Net Fixed Assets	-	-	4,550.0	4,470.0	4,390.0	4,310.0	4,230.0	4,070.0	3,990.0	3,590.0	3,510.0	3,430.0	3,350.0	3,270.0	3,190.0
Capital Works In Progress	410.0	4,630.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Current Assets															
Cash Balance	-	-	628.6	1,268.4	1,908.7	2,549.7	3,191.2	4,476.3	5,119.8	8,686.0	9,394.2	10,092.7	10,996.5	11,900.4	12,804.2
Accounts Receivable															
Inventory															
Total Current Assets	**-**	**-**	**628.6**	**1,268.4**	**1,908.7**	**2,549.7**	**3,191.2**	**4,476.3**	**5,119.8**	**8,686.0**	**9,394.2**	**10,092.7**	**10,996.5**	**11,900.4**	**12,804.2**
TOTAL ASSETS	**410.0**	**4,630.0**	**5,178.6**	**5,738.4**	**6,298.7**	**6,859.7**	**7,421.2**	**8,546.3**	**9,109.8**	**12,276.0**	**12,904.2**	**13,522.7**	**14,346.5**	**15,170.4**	**15,994.2**
Current Liabilities															
Accounts Payable															
Current Portion of Long Term Loans	-		103.7	108.9	114.4	120.1	126.1	139.0	146.0	186.3	195.6	205.4	-	-	-
Total Current Liabilities	**-**	**-**	**103.7**	**108.9**	**114.4**	**120.1**	**126.1**	**139.0**	**146.0**	**186.3**	**195.6**	**205.4**	**-**	**-**	**-**
Financing															
Retained Earnings	-	-	652.3	1,321.0	1,995.8	2,676.8	3,364.4	4,760.8	5,470.4	9,483.4	10,307.2	11,131.1	11,954.9	12,778.8	13,602.6
Long Term Loans	290.0	3,430.0	3,222.5	3,108.4	2,988.6	2,862.8	2,730.7	2,446.4	2,293.5	1,406.3	1,201.4	986.2	1,191.6	1,191.6	1,191.6
Equity	120.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0	1,200.0
TOTAL LIABILITIES & EQUITY	**410.0**	**4,630.0**	**5,178.6**	**5,738.4**	**6,298.7**	**6,859.7**	**7,421.2**	**8,546.3**	**9,109.8**	**12,276.0**	**12,904.2**	**13,522.7**	**14,346.5**	**15,170.4**	**15,994.2**

FINANCIAL SUMMARY (Récapitulatif Financier) @ 0% tax

	2012	2017	2018	2019	2020	2021	2022	2024	2025	2030	2031	2032	2033	2034	2035
Average Net Fixed Assets (A)	-	-	4,590.0	4,510.0	4,430.0	4,350.0	4,270.0	4,110.0	4,030.0	3,630.0	3,550.0	3,470.0	3,390.0	3,310.0	3,230.0
Net Income Before Interest & Taxes (B)	-	-	823.8	823.8	823.8	823.8	823.8	823.8	823.8	823.8	823.8	823.8	823.8	823.8	823.8
Net Income After Taxes ©	-	-	652.3	668.7	674.7	681.0	687.6	701.9	709.5	823.8	823.8	823.8	823.8	823.8	823.8
Net Cash Flow	-	-	628.6	639.8	640.3	640.9	641.5	642.9	643.6	717.6	708.2	698.5	903.8	903.8	903.8
Cummulative Cash Balance	-	-	628.6	1,268.4	1,908.7	2,549.7	3,191.2	4,476.3	5,119.8	8,686.0	9,394.2	10,092.7	10,996.5	11,900.4	12,804.2
Current Assets (D)	-	-	628.6	1,268.4	1,908.7	2,549.7	3,191.2	4,476.3	5,119.8	8,686.0	9,394.2	10,092.7	10,996.5	11,900.4	12,804.2
Current Liabilities (E)	-	-	103.7	108.9	114.4	120.1	126.1	139.0	146.0	186.3	195.6	205.4	-	-	-
Interest Payment (F)	-	-	171.5	155.1	149.1	142.8	136.2	122.0	114.3	-	-	-	-	-	-
Principal Repayment (G)	-	-	103.7	108.9	114.4	120.1	126.1	139.0	146.0	186.3	195.6	205.4	-	-	-
G/(1 - Tax Rate) (H)	-	-	103.7	108.9	114.4	120.1	126.1	139.0	146.0	186.3	195.6	205.4	-	-	-
Total Debt Service Burden (F+H)	-	-	275.2	264.1	263.5	262.9	262.3	261.0	260.3	186.3	195.6	205.4	-	-	-
Return on Average net Fixed Assets(B/A)			18%	18%	19%	19%	19%	20%	20%	23%	23%	24%	**21%**		
Current ratio (D/E)			6.1	11.6	16.7	21.2	25.3	32.2	35.1	46.6	48.0	49.1	**32.5**		
Debt Service Cover Ratio (B/(F+H))			3.0	3.1	3.1	3.1	3.1	3.2	3.2	4.4	4.2	4.0	**3.7**		
NPV (US$m)	**2,834**														

	ENERGY GENERATION (GWh)														
SOUAPITI HYDRO	**2012**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Annual Generation			3,667	3,667	3,667	3,667	3,667	3,667	3,667	3,667	3,667	3,667	3,667	3,667	3,667
TOTAL	**-**	**-**	**3,667**	**3,667**	**3,667**	**3,667**	**3,667**	**3,667**	**3,667**	**3,667**	**3,667**	**3,667**	**3,667**		
	Bulk Generation Tariff, BGT *- US$/kWh*														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Annual BGT	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826
	Revenue *(Recettes)* - US$ million														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Annual Revenues	-	-	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89
TOTAL	-	-	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89

	Income Statement *(Etat des Recettes)* - US$million														
SOUAPITI HYDRO	**2012**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
TOTAL REVENUE	-	-	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89	302.89
COSTS															
Operating and Maintenance - O&M			5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Management and Administration - M&A			1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Environmental			-	-	-	-	-	-	-	0.00					
Depreciation	-	-	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.92	15.92	15.92	15.92	15.92	15.92
Total Operating Costs	-	**-**	**23.25**	**23.25**	**23.25**	**23.25**	**23.25**	**23.25**	**23.25**	**23.25**	**23.25**	**23.25**	**23.25**	**23.25**	**23.25**
Operating Income Before Interest	-	-	279.6	279.6	279.6	279.6	279.6	279.6	279.6	279.6	279.6	279.6	279.6	279.6	279.6
Loan Interest	-		34.1	30.9	29.7	28.4	27.1	24.3	22.7	-	-	-	-	-	-
Net Income Before Tax	-		245.5	248.8	250.0	251.2	252.5	255.4	256.9	279.6	279.6	279.6	279.6	279.6	279.6
Income Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Income After Tax	-	-	245.5	248.8	250.0	251.2	252.5	255.4	256.9	279.6	279.6	279.6	279.6	279.6	279.6
Dividend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings	-	-	245.5	248.8	250.0	251.2	252.5	255.4	256.9	279.6	279.6	279.6	279.6	279.6	279.6
Cumulative Earnings Retained	-	-	245.5	494.3	744.2	995.5	1,248.0	1,757.3	2,014.2	3,391.2	3,670.9	3,950.5	4,230.1	4,509.8	4,789.4
	CASHFLOW *(Flux de Trésorerie)* - US$ million														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
INFLOWS															
Net Income After Tax	-	-	245.51	248.77	249.96	251.21	252.53	255.37	256.89	279.6	279.6	279.6	279.6	279.6	279.6
Depreciation	-	-	15.92	15.92	15.92	15.92	15.92	15.92	15.92	15.9	15.9	15.9	15.9	15.9	15.9
Loan drawdown & IDC	57.7	93.5	-												
Equity drawdown	23.9	23.9													
Total Inflows	81.6	117.4	261.4	264.7	265.9	267.1	268.5	271.3	272.8	295.6	295.6	295.6	295.6	295.6	295.6
OUTFLOWS															
Capital Investments	81.6	117.4													
Loan Repayment	-		20.6	21.7	22.8	23.9	25.1	27.7	29.0	37.1	38.9	40.9	-	-	-
Dividend Paid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Outflows	81.6	117.4	20.6	21.7	22.8	23.9	25.1	27.7	29.0	37.1	38.9	40.9	-	-	-
NET CASHFLOWS	-	-	240.8	243.0	243.1	243.2	243.4	243.6	243.8	258.5	256.6	254.7	295.6	295.6	295.6
Cumulative Cash Balance	-	-	240.8	483.8	726.9	970.2	1,213.5	1,700.6	1,944.4	3,232.5	3,489.2	3,743.9	4,039.4	4,335.0	4,630.5

	BALANCE SHEET *(Bilan)* - *US$* million														
SOUAPITI HYDRO	**2012**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Net Fixed Assets	-	-	905.5	889.5	873.6	857.7	841.8	809.9	794.0	714.4	698.5	682.6	666.7	650.7	634.8
Capital Works In Progress	81.6	921.4	-	-	-	-	-	-	-	-	-	-	-	-	-
Current Assets															
Cash Balance	-	-	240.8	483.8	726.9	970.2	1,213.5	1,700.6	1,944.4	3,232.5	3,489.2	3,743.9	4,039.4	4,335.0	4,630.5
Accounts Receivable															
Inventory															
Total Current Assets	**-**	**-**	**240.8**	**483.8**	**726.9**	**970.2**	**1,213.5**	**1,700.6**	**1,944.4**	**3,232.5**	**3,489.2**	**3,743.9**	**4,039.4**	**4,335.0**	**4,630.5**
TOTAL ASSETS	**81.6**	**921.4**	**1,146.2**	**1,373.3**	**1,600.5**	**1,827.8**	**2,055.3**	**2,510.6**	**2,738.4**	**3,946.9**	**4,187.7**	**4,426.4**	**4,706.1**	**4,985.7**	**5,265.3**
Current Liabilities															
Accounts Payable															
Current Portion of Long Term Loans	-		20.6	21.7	22.8	23.9	25.1	27.7	29.0	37.1	38.9	40.9	-	-	-
Total Current Liabilities	**-**	**-**	**20.6**	**21.7**	**22.8**	**23.9**	**25.1**	**27.7**	**29.0**	**37.1**	**38.9**	**40.9**	**-**	**-**	**-**
Financing															
Retained Earnings	-	-	245.5	494.3	744.2	995.5	1,248.0	1,757.3	2,014.2	3,391.2	3,670.9	3,950.5	4,230.1	4,509.8	4,789.4
Long Term Loans	57.7	682.6	641.3	618.6	594.7	569.7	543.4	486.8	456.4	279.9	239.1	196.3	237.1	237.1	237.1
Equity	23.9	238.8	238.8	238.8	238.8	238.8	238.8	238.8	238.8	238.8	238.8	238.8	238.8	238.8	238.8
TOTAL LIABILITIES & EQUITY	**81.6**	**921.4**	**1,146.2**	**1,373.3**	**1,600.5**	**1,827.8**	**2,055.3**	**2,510.6**	**2,738.4**	**3,946.9**	**4,187.7**	**4,426.4**	**4,706.1**	**4,985.7**	**5,265.3**

FINANCIAL SUMMARY (Récapitulatif Financier) @ 0% tax

	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2024**	**2025**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Average Net Fixed Assets (A)	-	-	913.4	897.5	881.6	865.7	849.7	817.9	802.0	722.4	706.5	690.5	674.6	658.7	642.8
Net Income Before Interest & Taxes (B)	-	-	279.6	279.6	279.6	279.6	279.6	279.6	279.6	279.6	279.6	279.6	279.6	279.6	279.6
Net Income After Taxes ©	-	-	245.5	248.8	250.0	251.2	252.5	255.4	256.9	279.6	279.6	279.6	279.6	279.6	279.6
Net Cash Flow	-	-	240.8	243.0	243.1	243.2	243.4	243.6	243.8	258.5	256.6	254.7	295.6	295.6	295.6
Cumulative Cash Balance	-	-	240.8	483.8	726.9	970.2	1,213.5	1,700.6	1,944.4	3,232.5	3,489.2	3,743.9	4,039.4	4,335.0	4,630.5
Current Assets (D)	-	-	240.8	483.8	726.9	970.2	1,213.5	1,700.6	1,944.4	3,232.5	3,489.2	3,743.9	4,039.4	4,335.0	4,630.5
Current Liabilities (E)	-	-	20.6	21.7	22.8	23.9	25.1	27.7	29.0	37.1	38.9	40.9	-	-	-
Interest Payment (F)	-	-	34.1	30.9	29.7	28.4	27.1	24.3	22.7	-	-	-	-	-	-
Principal Repayment (G)	-	-	20.6	21.7	22.8	23.9	25.1	27.7	29.0	37.1	38.9	40.9	-	-	-
G/(1 - Tax Rate) (H)	-	-	20.6	21.7	22.8	23.9	25.1	27.7	29.0	37.1	38.9	40.9	-	-	-
Total Debt Service Burden (F+H)	-	-	54.8	52.5	52.4	52.3	52.2	51.9	51.8	37.1	38.9	40.9	-	-	-
Return on Average net Fixed Assets(B/A)			31%	31%	32%	32%	33%	34%	35%	39%	40%	40%	**35%**		
Current ratio (D/E)			11.7	22.3	31.9	40.6	48.4	61.5	66.9	87.2	89.6	91.6	**61.4**		
Debt Service Cover Ratio (B/(F+H))			5.1	5.3	5.3	5.3	5.4	5.4	5.4	7.5	7.2	6.8	**6.3**		
NPV (US$m)	**1,167**														

	ENERGY GENERATION (GWh)														
COMBINE CYCLE NG PLANT	**2012**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2032**	**2033**	**2034**	**2035**
Annual Generation					3,351	3,351	3,351	3,351	3,351	3,351	3,351	3,351	3,351	3,351	3,351
TOTAL	**-**	**-**	**-**	**-**	**3,351**	**3,351**	**3,351**	**3,351**	**3,351**	**3,351**	**3,351**	**3,351**	**3,351**	**3,351**	**3,351**
	Bulk Generation Tariff, BGT - *US$/kWh*														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2032**	**2033**	**2034**	**2035**
Annual BGT	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826
	Revenue *(Recettes)* - US$ million														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2032**	**2033**	**2034**	**2035**
Annual Revenues	-	-	-	-	276.79	276.79	276.79	276.79	276.79	276.79	276.79	276.79	276.79	276.79	276.79
TOTAL	-	-	-	-	276.79	276.79	276.79	276.79	276.79	276.79	276.79	276.79	276.79	276.79	276.79

	Income Statement *(Etat des Recettes)* - US$million														
COMBINE CYCLE NG PROJECT	**2012**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2032**	**2033**	**2034**	**2035**
TOTAL REVENUE	-	-	-	-	276.79	276.79	276.79	276.79	276.79	276.79	276.79	276.79	276.79	276.79	276.79
COSTS															
Operating and Maintenance - O&M					5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Management and Administration - M&A					0.01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Depreciation	-	-	-	-	16.0	16.0	16.0	16.0	16.0	16.0	16.04	16.04	16.04	16.04	16.04
Total Operating Costs	-	**-**	**-**	**-**	**21.09**	**21.09**	**21.09**	**21.09**	**21.09**	**21.09**	**21.09**	**21.09**	**21.09**	**21.09**	**21.09**
Operating Income Before Interest	-	-	-	-	255.7	255.7	255.7	255.7	255.7	255.7	255.7	255.7	255.7	255.7	255.7
Loan Interest	-				14.1	13.0	11.8	10.6	9.3	7.9	-	-	-	-	-
Net Income Before Tax	-		-	-	241.6	242.7	243.9	245.1	246.4	247.8	255.7	255.7	255.7	255.7	255.7
Income Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Income After Tax	-	-	-	-	241.6	242.7	243.9	245.1	246.4	247.8	255.7	255.7	255.7	255.7	255.7
Dividend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings	-	-	-	-	241.6	242.7	243.9	245.1	246.4	247.8	255.7	255.7	255.7	255.7	255.7
Cumulative Earnings Retained	-	-	-	-	241.6	484.3	728.2	973.3	1,219.8	1,467.6	2,729.5	3,240.9	3,496.6	3,752.3	4,008.0
	CASHFLOW *(Flux de Trésorerie)* - US$ million														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2032**	**2033**	**2034**	**2035**
INFLOWS															
Net Income After Tax	-	-	-	-	241.59	242.71	243.89	245.13	246.43	247.79	255.7	255.7	255.7	255.7	255.7
Depreciation	-	-	-	-	16.04	16.04	16.04	16.04	16.04	16.04	16.0	16.0	16.0	16.0	16.0
Loan drawdown & IDC	-	46.5	102.1	155.4											
Equity drawdown	-	19.2	40.9	60.2											
Total Inflows	-	65.8	143.0	215.5	257.6	258.8	259.9	261.2	262.5	263.8	271.7	271.7	271.7	271.7	271.7
OUTFLOWS															
Capital Investments	-	65.8	143.0	215.5											
Loan Repayment	-				22.4	23.6	24.7	26.0	27.3	28.6	-	-	-	-	-
Dividend Paid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Outflows	-	65.8	143.0	215.5	22.4	23.6	24.7	26.0	27.3	28.6	-	-	-	-	-
NET CASHFLOWS	-	-	-	-	235.2	235.2	235.2	235.2	235.2	235.2	271.7	271.7	271.7	271.7	271.7
Cumulative Cash Balance	-	-	-	-	235.2	470.4	705.6	940.8	1,175.9	1,411.1	2,623.6	3,167.1	3,438.9	3,710.6	3,982.4

	BALANCE SHEET *(Bilan)* - *US$* million														
COMBINE CYCLE NG PROJECT	**2012**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2032**	**2033**	**2034**	**2035**
Net Fixed Assets	-	-	-	-	408.2	392.2	376.1	360.1	344.1	328.0	247.8	215.7	199.7	183.7	167.6
Capital Works In Progress	-	65.8	208.7	424.3	-	-	-	-	-	-	-	-	-	-	-
Current Assets															
Cash Balance	-	-	-	-	235.2	470.4	705.6	940.8	1,175.9	1,411.1	2,623.6	3,167.1	3,438.9	3,710.6	3,982.4
Accounts Receivable															
Inventory															
Total Current Assets	**-**	**-**	**-**	**-**	**235.2**	**470.4**	**705.6**	**940.8**	**1,175.9**	**1,411.1**	**2,623.6**	**3,167.1**	**3,438.9**	**3,710.6**	**3,982.4**
TOTAL ASSETS	**-**	**65.8**	**208.7**	**424.3**	**643.4**	**862.6**	**1,081.7**	**1,300.8**	**1,520.0**	**1,739.1**	**2,871.4**	**3,382.9**	**3,638.6**	**3,894.3**	**4,150.0**
Current Liabilities															
Accounts Payable															
Current Portion of Long Term Loans	-				22.4	23.6	24.7	26.0	27.3	28.6	-	-	-	-	-
Total Current Liabilities	**-**	**-**	**-**	**-**	**22.4**	**23.6**	**24.7**	**26.0**	**27.3**	**28.6**	**-**	**-**	**-**	**-**	**-**
Financing															
Retained Earnings	-	-	-	-	241.6	484.3	728.2	973.3	1,219.8	1,467.6	2,729.5	3,240.9	3,496.6	3,752.3	4,008.0
Long Term Loans	-	46.5	148.6	304.0	259.1	234.4	208.5	181.2	152.7	122.6	21.7	21.7	21.7	21.7	21.7
Equity	-	19.2	60.2	120.3	120.3	120.3	120.3	120.3	120.3	120.3	120.3	120.3	120.3	120.3	120.3
TOTAL LIABILITIES & EQUITY	**-**	**65.8**	**208.7**	**424.3**	**643.4**	**862.6**	**1,081.7**	**1,300.8**	**1,520.0**	**1,739.1**	**2,871.4**	**3,382.9**	**3,638.6**	**3,894.3**	**4,150.0**

FINANCIAL SUMMARY (Récapitulatif Financier) @ 0% tax

	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2032**	**2033**	**2034**	**2035**
Average Net Fixed Assets (A)	-	-	-	-	405.4	400.2	384.2	368.1	352.1	336.0	255.8	223.8	207.7	191.7	175.6
Net Income Before Interest & Taxes (B)	-	-	-	-	255.7	255.7	255.7	255.7	255.7	255.7	255.7	255.7	255.7	255.7	255.7
Net Income After Taxes ©	-	-	-	-	241.6	242.7	243.9	245.1	246.4	247.8	255.7	255.7	255.7	255.7	255.7
Net Cash Flow	-	-	-	-	235.2	235.2	235.2	235.2	235.2	235.2	271.7	271.7	271.7	271.7	271.7
Cumulative Cash Balance	-	-	-	-	235.2	470.4	705.6	940.8	1,175.9	1,411.1	2,623.6	3,167.1	3,438.9	3,710.6	3,982.4
Current Assets (D)	-	-	-	-	235.2	470.4	705.6	940.8	1,175.9	1,411.1	2,623.6	3,167.1	3,438.9	3,710.6	3,982.4
Current Liabilities (E)	-	-	-	-	22.4	23.6	24.7	26.0	27.3	28.6	-	-	-	-	-
Interest Payment (F)	-	-	-	-	14.1	13.0	11.8	10.6	9.3	7.9	-	-	-	-	-
Principal Repayment (G)	-	-	-	-	22.4	23.6	24.7	26.0	27.3	28.6	-	-	-	-	-
G/(1 - Tax Rate) (H)	-	-	-	-	22.4	23.6	24.7	26.0	27.3	28.6	-	-	-	-	-
Total Debt Service Burden (F+H)	-	-	-	-	36.6	36.6	36.6	36.6	36.6	36.6	-	-	-	-	-
Return on Average net Fixed Assets(B/A)					63%	64%	67%	69%	73%	76%	**76%**				
Current ratio (D/E)					10.5	20.0	28.5	36.2	43.1	49.3	**43.3**				
Debt Service Cover Ratio (B/(F+H))					7.0	7.0	7.0	7.0	7.0	7.0	**7.0**				
NPV (US$m)	**1,684**														

	ENERGY GENERATION (GWh)														
WIND TURBINE PROJECT	**2012**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2034**	**2035**
Annual Generation					400	400	400	400	400	400	400	400	400	400	400
TOTAL	**-**	**-**	**-**	**-**	**400**	**400**	**400**	**400**	**400**	**400**					
	Bulk Generation Tariff, BGT - *US$/kWh*														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2034**	**2035**
Annual BGT	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826
	Revenue *(Recettes)* - US$ million														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2034**	**2035**
Annual Revenues	-	-	-	-	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04
TOTAL	-	-	-	-	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04

	Income Statement *(Etat des Recettes)* - US$ million														
WIND TURBINE PROJECT	**2012**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2034**	**2035**
TOTAL REVENUE	-	-	-	-	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04	33.04
COSTS															
Operating and Maintenance - Fixed O&M					3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
Variable O&M					3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Environment			-	-											
Depreciation	-	-	-	-	15.9	15.9	15.9	15.9	15.9	15.9	15.90	15.90	15.90	15.90	15.90
Total Operating Costs	-	**-**	**-**	**-**	**23.10**	**23.10**	**23.10**	**23.10**	**23.10**	**23.10**	**23.10**	**23.10**	**23.10**	**23.10**	**23.10**
Operating Income Before Interest	-	-	-	-	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9
Loan Interest	-				11.1	10.2	9.3	8.3	7.3	6.2	0.0	0.0	0.0	-	-
Net Income Before Tax	-		-	-	(1.2)	(0.3)	0.6	1.6	2.6	3.7	9.9	9.9	9.9	9.9	9.9
Income Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Income After Tax	-	-	-	-	(1.2)	(0.3)	0.6	1.6	2.6	3.7	9.9	9.9	9.9	9.9	9.9
Dividend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings	-	-	-	-	(1.2)	(0.3)	0.6	1.6	2.6	3.7	9.9	9.9	9.9	9.9	9.9
Cumulative Earnings Retained	-	-	-	-	(1.2)	(1.5)	(0.9)	0.7	3.4	7.1	43.7	53.6	63.5	83.4	93.4
	CASHFLOW *(Flux de Trésorerie)* - US$ million														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2034**	**2035**
INFLOWS															
Net Income After Tax	-	-	-	-	(1.19)	(0.31)	0.62	1.60	2.62	3.70	9.9	9.9	9.9	9.9	9.9
Depreciation	-	-	-	-	15.90	15.90	15.90	15.90	15.90	15.90	15.9	15.9	15.9	15.9	15.9
Loan drawdown & IDC	-	-	161.4	80.3											
Equity drawdown	-	-	66.8	28.6											
Total Inflows	-	-	228.2	108.9	14.7	15.6	16.5	17.5	18.5	19.6	25.8	25.8	25.8	25.8	25.8
OUTFLOWS															
Capital Investments	-	-	228.2	108.9											
Loan Repayment	-				17.7	18.6	19.5	20.5	21.5	22.6	(0.0)	(0.0)	(0.0)	-	-
Dividend Paid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Outflows	-	-	228.2	108.9	17.7	18.6	19.5	20.5	21.5	22.6	(0.0)	(0.0)	(0.0)	-	-
NET CASHFLOWS	-	-	-	-	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)	25.8	25.8	25.8	25.8	25.8
Cumulative Cash Balance	-	-	-	-	(3.0)	(6.0)	(9.0)	(12.0)	(14.9)	(17.9)	(4.0)	21.8	47.6	99.3	125.2

	BALANCE SHEET *(Bilan)* - *US$* million

WIND TURBINE PROJECT	2012	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2031	2032	2034	2035
Net Fixed Assets	-	-	-	-	319.8	304.8	288.9	273.0	257.1	241.2	161.7	145.8	129.9	98.1	82.2
Capital Works In Progress	-	-	228.2	337.1	-	-	-	-	-	-	-	-	-	-	-
Current Assets															
Cash Balance	-	-	-	-	(3.0)	(6.0)	(9.0)	(12.0)	(14.9)	(17.9)	(4.0)	21.8	47.6	99.3	125.2
Accounts Receivable															
Inventory															
Total Current Assets	**-**	**-**	**-**	**-**	**(3.0)**	**(6.0)**	**(9.0)**	**(12.0)**	**(14.9)**	**(17.9)**	**(4.0)**	**21.8**	**47.6**	**99.3**	**125.2**
TOTAL ASSETS	**-**	**-**	**228.2**	**337.1**	**316.8**	**298.8**	**279.9**	**261.0**	**242.1**	**223.3**	**157.6**	**167.6**	**177.5**	**197.4**	**207.3**
Current Liabilities															
Accounts Payable															
Current Portion of Long Term Loans	-				17.7	18.6	19.5	20.5	21.5	22.6	(0.0)	(0.0)	(0.0)	-	-
Total Current Liabilities	**-**	**-**	**-**	**-**	**17.7**	**18.6**	**19.5**	**20.5**	**21.5**	**22.6**	**(0.0)**	**(0.0)**	**(0.0)**	**-**	**-**
Financing															
Retained Earnings	-	-	-	-	(1.2)	(1.5)	(0.9)	0.7	3.4	7.1	43.7	53.6	63.5	83.4	93.4
Long Term Loans	-	-	161.4	241.7	204.9	186.3	166.8	146.3	124.8	102.2	0.0	0.0	0.0	0.0	0.0
Equity	-	-	66.8	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4	95.4
TOTAL LIABILITIES & EQUITY	**-**	**-**	**228.2**	**337.1**	**316.8**	**298.8**	**280.8**	**262.9**	**245.1**	**227.3**	**139.1**	**149.0**	**158.9**	**178.8**	**188.8**

FINANCIAL SUMMARY (Récapitulatif Financier) @ 0% tax

	2012	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2031	2032	2034	2035
Average Net Fixed Assets (A)	-	-	-	-	318.9	312.3	296.8	280.9	265.0	249.1	169.6	153.7	137.8	106.0	90.1
Net Income Before Interest & Taxes (B)	-	-	-	-	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9	9.9
Net Income After Taxes ©	-	-	-	-	(1.2)	(0.3)	0.6	1.6	2.6	3.7	9.9	9.9	9.9	9.9	9.9
Net Cash Flow	-	-	-	-	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)	(3.0)	25.8	25.8	25.8	25.8	25.8
Cumulative Cash Balance	-	-	-	-	(3.0)	(6.0)	(9.0)	(12.0)	(14.9)	(17.9)	(4.0)	21.8	47.6	99.3	125.2
Current Assets (D)	-	-	-	-	(3.0)	(6.0)	(9.0)	(12.0)	(14.9)	(17.9)	(4.0)	21.8	47.6	99.3	125.2
Current Liabilities (E)	-	-	-	-	17.7	18.6	19.5	20.5	21.5	22.6	(0.0)	(0.0)	(0.0)	-	-
Interest Payment (F)	-	-	-	-	11.1	10.2	9.3	8.3	7.3	6.2	0.0	0.0	0.0	-	-
Principal Repayment (G)	-	-	-	-	17.7	18.6	19.5	20.5	21.5	22.6	(0.0)	(0.0)	(0.0)	-	-
G/(1 - Tax Rate) (H)	-	-	-	-	17.7	18.6	19.5	20.5	21.5	22.6	(0.0)	(0.0)	(0.0)	-	-
Total Debt Service Burden (F+H)	-	-	-	-	28.8	28.8	28.8	28.8	28.8	28.8	(0.0)	(0.0)	(0.0)	-	-
Return on Average net Fixed Assets(B/A)					3%	3%	3%	4%	4%	4%	**4%**				
Current ratio (D/E)					(0.2)	(0.3)	(0.5)	(0.6)	(0.7)	(0.8)	**(0.7)**				
Debt Service Cover Ratio (B/(F+H))					0.3	0.3	0.3	0.3	0.3	0.3	**0.3**				
NPV (US$m)	3														

	ENERGY GENERATION (GWh)														
SOLAR PV PROJECT	2012	2017	2018	2019	2020	2021	2022	2023	2024	2025	2030	2031	2032	2034	2035
Annual Generation					618	618	618	618	618	618	618	618	618	618	618

TOTAL	**-**	**-**	**-**	**-**	**618**	**618**	**618**	**618**	**618**	**618**					
	Bulk Generation Tariff, BGT - *US$/kWh*														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2034**	**2035**
Annual BGT	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826	0.0826
	Revenue *(Recettes)* - US$ million														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2034**	**2035**
Annual Revenues	-	-	-	-	51.05	51.05	51.05	51.05	51.05	51.05	51.0468	51.0468	51.0468	51.0468	51.0468
TOTAL	-	-	-	-	51.05	51.05	51.05	51.05	51.05	51.05	51.05	51.05	51.05	51.05	51.05

	Income Statement *(Etat des Recettes)* - US$million														
SOLAR PV PROJECT	**2012**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2034**	**2035**
TOTAL REVENUE	-	-	-	-	51.05	51.05	51.05	51.05	51.05	51.05	51.05	51.05	51.05	51.05	51.05
COSTS															
Operating and Maintenance - Fixed O&M					3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Variable O&M					-	-	-	-	-	-	-	-	-	-	-
Environment			-	-											
Depreciation	-	-	-	-	27.5	27.5	27.5	27.5	27.5	27.5	27.45	27.45	27.45	27.45	27.45
Total Operating Costs	-	**-**	**-**	**-**	**30.45**	**30.45**	**30.45**	**30.45**	**30.45**	**30.45**	**30.45**	**30.45**	**30.45**	**30.45**	**30.45**
Operating Income Before Interest	-	-	-	-	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6
Loan Interest	-				19.9	18.3	16.7	14.9	13.1	11.2	0.0	0.0	0.0	-	-
Net Income Before Tax	-		-	-	0.7	2.3	3.9	5.7	7.5	9.4	20.6	20.6	20.6	20.6	20.6
Income Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Net Income After Tax	-	-	-	-	0.7	2.3	3.9	5.7	7.5	9.4	20.6	20.6	20.6	20.6	20.6
Dividend	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Retained Earnings	-	-	-	-	0.7	2.3	3.9	5.7	7.5	9.4	20.6	20.6	20.6	20.6	20.6
Cumulative Earnings Retained	-	-	-	-	0.7	3.0	6.9	12.6	20.1	29.5	109.1	129.7	150.3	191.5	212.1
	CASHFLOW *(Flux de Trésorerie)* - US$ million														
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2034**	**2035**
INFLOWS															
Net Income After Tax	-	-	-	-	0.70	2.28	3.94	5.68	7.52	9.44	20.6	20.6	20.6	20.6	20.6
Depreciation	-	-	-	-	27.45	27.45	27.45	27.45	27.45	27.45	27.5	27.5	27.5	27.5	27.5
Loan drawdown & IDC	-	-	-	398.0											
Equity drawdown	-	-	-	164.7											
Total Inflows	-	-	-	562.7	28.1	29.7	31.4	33.1	35.0	36.9	48.0	48.0	48.0	48.0	48.0
OUTFLOWS															
Capital Investments	-	-	-	562.7											
Loan Repayment	-				31.6	33.2	34.9	36.6	38.5	40.4	(0.0)	(0.0)	(0.0)	-	-
Dividend Paid	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Outflows	-	-	-	562.7	31.6	33.2	34.9	36.6	38.5	40.4	(0.0)	(0.0)	(0.0)	-	-
NET CASHFLOWS	-	-	-	-	(3.5)	(3.5)	(3.5)	(3.5)	(3.5)	(3.5)	48.0	48.0	48.0	48.0	48.0
Cumulative Cash Balance	-	-	-	-	(3.5)	(7.0)	(10.5)	(14.0)	(17.5)	(21.0)	13.1	61.1	109.1	205.2	253.3

	BALANCE SHEET *(Bilan) - US$* million														
SOLAR PV PROJECT	**2012**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2034**	**2035**

Net Fixed Assets	-	-	-	-	566.9	539.5	512.0	484.6	457.1	429.7	292.4	265.0	237.5	182.6	155.2
Capital Works In Progress	-	-	-	562.7	-	-	-	-	-	-	-	-	-	-	-
Current Assets															
Cash Balance	-	-	-	-	(3.5)	(7.0)	(10.5)	(14.0)	(17.5)	(21.0)	13.1	61.1	109.1	205.2	253.3
Accounts Receivable															
Inventory															
Total Current Assets	**-**	**-**	**-**	**-**	**(3.5)**	**(7.0)**	**(10.5)**	**(14.0)**	**(17.5)**	**(21.0)**	**13.1**	**61.1**	**109.1**	**205.2**	**253.3**
TOTAL ASSETS	**-**	**-**	**-**	**562.7**	**563.4**	**532.5**	**501.5**	**475.6**	**446.4**	**417.4**	**305.5**	**326.1**	**346.7**	**387.9**	**408.5**
Current Liabilities															
Accounts Payable															
Current Portion of Long Term Loans	-				31.6	33.2	34.9	36.6	38.5	40.4	(0.0)	(0.0)	(0.0)	-	-
Total Current Liabilities	**-**	**-**	**-**	**-**	**31.6**	**33.2**	**34.9**	**36.6**	**38.5**	**40.4**	**(0.0)**	**(0.0)**	**(0.0)**	**-**	**-**
Financing															
Retained Earnings	-	-	-	-	0.7	3.0	6.9	12.6	20.1	29.5	109.1	129.7	150.3	191.5	212.1
Long Term Loans	-	-	-	398.0	366.4	333.2	298.3	261.6	223.2	182.8	0.0	0.0	0.0	0.0	0.0
Equity	-	-	-	164.7	164.7	164.7	164.7	164.7	164.7	164.7	164.7	164.7	164.7	164.7	164.7
TOTAL LIABILITIES & EQUITY	**-**	**-**	**-**	**562.7**	**563.4**	**532.5**	**501.5**	**475.6**	**446.4**	**417.4**	**305.5**	**326.1**	**346.7**	**387.9**	**408.5**
FINANCIAL SUMMARY (Récapitulatif Financier) @ 0% tax															
	2012	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2030**	**2031**	**2032**	**2034**	**2035**
Average Net Fixed Assets (A)	-	-	-	-	564.8	553.2	525.8	498.3	470.9	443.4	306.2	278.7	251.3	196.4	168.9
Net Income Before Interest & Taxes (B)	-	-	-	-	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6
Net Income After Taxes ©	-	-	-	-	0.7	2.3	3.9	5.7	7.5	9.4	20.6	20.6	20.6	20.6	20.6
Net Cash Flow	-	-	-	-	(3.5)	(3.5)	(3.5)	(3.5)	(3.5)	(3.5)	48.0	48.0	48.0	48.0	48.0
Cumulative Cash Balance	-	-	-	-	(3.5)	(7.0)	(10.5)	(14.0)	(17.5)	(21.0)	13.1	61.1	109.1	205.2	253.3
Current Assets (D)	-	-	-	-	(3.5)	(7.0)	(10.5)	(14.0)	(17.5)	(21.0)	13.1	61.1	109.1	205.2	253.3
Current Liabilities (E)	-	-	-	-	31.6	33.2	34.9	36.6	38.5	40.4	(0.0)	(0.0)	(0.0)	-	-
Interest Payment (F)	-	-	-	-	19.9	18.3	16.7	14.9	13.1	11.2	0.0	0.0	0.0	-	-
Principal Repayment (G)	-	-	-	-	31.6	33.2	34.9	36.6	38.5	40.4	(0.0)	(0.0)	(0.0)	-	-
G/(1 - Tax Rate) (H)	-	-	-	-	31.6	33.2	34.9	36.6	38.5	40.4	(0.0)	(0.0)	(0.0)	-	-
Total Debt Service Burden (F+H)	-	-	-	-	51.5	51.5	51.5	51.5	51.5	51.5	(0.0)	(0.0)	(0.0)	-	-
Return on Average net Fixed Assets(B/A)					4%	4%	4%	4%	4%	5%	**5%**				
Current ratio (D/E)					(0.1)	(0.2)	(0.3)	(0.4)	(0.5)	(0.5)	**(0.5)**				
Debt Service Cover Ratio (B/(F+H))					0.4	0.4	0.4	0.4	0.4	0.4	**0.4**				
NPV (US$ m)	**11.46**														

APPENDIX 3.4: FINANCIAL EVALUATION OF ZONE A COUNTRIES (WITHOUT PROJECTS CASE)

	ENERGY								NET BENEFITS										
	DOMESTIC ENERGY SALES																Present Worth		
	Ghana	Burkina Faso	Niger	Nigeria	Cote d'Ivoire	Togo	Benin	TOTAL	Ghana	Burkina Faso	Niger	Nigeria	Cote d'Ivoire	Togo	Benin	TOTAL	8%	10%	12%
2011	10,516	1,073	650	25,505	5,932	1,041	1,340	**46,058**	7	106	(10)	182	155	85	25	**548**	548	548	548
2012	11,123	1,146	698	29,072	6,312	1,293	1,468	**51,111**	110	67	(13)	128	216	109	41	**658**	609	598	587
2013	12,265	1,236	748	33,129	6,716	1,439	1,563	**57,097**	159	134	(15)	96	282	124	49	**829**	711	685	661
2014	12,943	1,339	799	37,756	7,158	1,570	1,696	**63,260**	35	159	(16)	96	300	(4)	38	**608**	483	457	433
2015	13,640	1,441	972	43,026	7,642	1,711	1,834	**70,266**	(37)	182	(20)	55	323	8	41	**551**	405	377	350
2016	14,408	1,556	1,063	49,031	8,101	1,872	1,967	**77,998**	148	104	(16)	741	355	2	(171)	**1,163**	792	722	660
2017	15,202	1,676	1,464	53,548	8,579	2,044	2,104	**84,619**	166	111	(63)	1,162	378	133	170	**2,058**	1,297	1,162	1,043
2018	16,054	1,803	1,552	58,469	9,070	2,228	2,247	**91,422**	245	127	(80)	1,338	440	106	59	**2,234**	1,304	1,147	1,011
2019	16,952	1,936	1,641	63,843	9,584	2,424	2,395	**98,775**	209	133	(146)	1,415	468	88	61	**2,228**	1,203	1,039	900
2020	17,914	2,080	1,733	69,702	10,124	2,607	2,575	**106,734**	190	145	(182)	1,477	493	(32)	(396)	**1,695**	848	719	611
2021	18,934	2,237	1,828	75,015	10,675	2,799	2,765	**114,253**	189	149	(212)	1,436	523	(38)	56	**2,103**	974	811	677
2022	20,024	2,400	1,925	81,884	11,257	3,002	2,965	**123,458**	118	146	(238)	1,315	555	(59)	(184)	**1,654**	709	580	475
2023	21,180	2,575	2,025	89,379	11,852	3,215	3,176	**133,402**	138	142	(255)	1,251	587	(67)	(176)	**1,620**	643	516	416
2024	22,413	2,762	2,128	97,548	12,477	3,440	3,398	**144,166**	155	132	(273)	1,157	619	(73)	(188)	**1,529**	562	443	350
2025	23,723	2,961	2,234	106,084	13,126	3,677	3,632	**155,438**	125	122	(290)	1,103	653	(62)	97	**1,747**	595	460	357
TOTAL	**247,292**	**28,222**	**21,460**	**912,991**	**138,606**	**34,364**	**35,123**		**1,955**	**1,959**	**(1,829)**	**12,953**	**6,346**			**-**	-	-	-
																NPV	**11,683**	**10,263**	**9,080**
																BC Ratio	**1.159**	**1.159**	**1.158**

Table 3.4.1: Evaluation WITHOUT Interconnection Projects (Zone A COUNTRIES)

	ENERGY										NET BENEFITS											
	DOMESTIC ENERGY SALES																			Present Worth		
	Senegal	Mali	Liberia	Sierra Leone	Cote d'Ivoire	Guinea	Guinea Bissau	Gambia	TOTAL		Senegal	Mali	Liberia	Sierra Leone	Cote d'Ivoire	Guinea	Guinea Bissau	Gambia	TOTAL	8%	10%	12%
2011	2,670	1,199	53	223	5,932	814	172	293	**11,355**		38	49	(1)	38	155	(3)	(13)	(22)	**241**	241	241	241
2012	2,986	1,301	117	293	6,312	960	188	357	**12,514**		40	50	(1)	49	216	(21)	(14)	(27)	**292**	271	266	261
2013	3,115	1,457	181	398	6,716	1,113	199	410	**13,589**		49	69	0	59	282	(38)	(15)	(30)	**376**	322	310	299
2014	3,261	2,212	252	533	7,158	1,294	210	463	**15,382**		(64)	121	(1)	69	317	(56)	(16)	(34)	**336**	267	253	239
2015	3,683	2,332	293	644	7,642	1,569	223	550	**16,935**		(64)	128	36	101	337	(66)	(17)	(41)	**414**	305	283	263
2016	4,239	3,026	310	784	8,101	1,768	236	697	**19,161**		(369)	220	39	112	355	(85)	(18)	9	**262**	179	163	149
2017	4,456	3,132	328	867	8,579	1,820	293	720	**20,196**		(399)	250	42	155	378	33	(22)	8	**444**	280	251	225
2018	4,690	3,297	351	907	9,070	1,877	354	744	**21,289**		(444)	304	45	162	440	31	(27)	6	**516**	301	265	234
2019	4,941	3,397	369	948	9,584	1,933	418	767	**22,359**		(465)	315	48	168	468	52	(32)	4	**559**	302	261	226
2020	5,217	3,554	398	996	10,124	1,991	486	790	**23,555**		(498)	334	53	175	493	74	(37)	2	**597**	298	253	215
2021	5,527	3,731	422	1,048	10,675	2,089	556	826	**24,874**		(539)	350	57	183	523	80	(43)	(1)	**611**	283	236	197
2022	5,831	3,911	451	1,101	11,257	2,157	587	855	**26,151**		(578)	365	62	190	555	84	(45)	(3)	**630**	270	221	181
2023	6,153	4,096	480	1,160	11,852	2,232	619	884	**27,476**		(620)	380	67	198	587	87	(47)	(5)	**648**	257	206	166
2024	6,499	4,285	509	1,212	12,477	2,301	652	919	**28,854**		(663)	394	72	205	619	90	(50)	(8)	**661**	243	191	151
2025	6,862	4,478	544	1,270	13,126	2,370	687	954	**30,293**		(705)	403	78	213	653	94	(52)	(10)	**673**	229	177	138
TOTAL	**70,129**	**45,409**	**5,059**	**12,384**	**138,606**	**26,289**	**5,878**	**10,228**			**(5,283)**	**3,734**	**599**	**2,077**	**6,377**	**357**						
																			NPV	**4,048**	**3,576**	**3,185**
																			BC Ratio	**1.815**	**1.723**	**1.642**

Table 3.4.2: Evaluation WITHOUT Interconnection Projects (Zone B COUNTRIES)

GHANA (WITHOUT)																	
	ENERGY						COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation		Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	10,516	438	-	-	10,767		1,036	-	-	**1,036**	1,042	-	**1,042**	**7**	7	7	7
2012	11,123	463	-	447	10,706		946	7	39	**992**	1,103	-	**1,103**	**110**	102	100	99
2013	12,265	511	301	-	13,775		1,080	-	-	**1,080**	1,216	24	**1,239**	**159**	137	132	127
2014	12,943	539	1,617	-	16,125		1,387	-	-	**1,387**	1,283	139	**1,422**	**35**	28	26	25
2015	13,640	568	1,346	-	16,796		1,510	-	-	**1,510**	1,352	121	**1,473**	**(37)**	(27)	(25)	(23)
2016	14,408	600	1,274	-	16,395		1,389	-	-	**1,389**	1,428	108	**1,536**	**148**	100	92	84
2017	15,202	633	212	-	16,096		1,359	-	-	**1,359**	1,507	18	**1,525**	**166**	105	94	84
2018	16,054	669	-	1,437	14,999		1,216	23	116	**1,355**	1,591	-	**1,591**	**236**	138	121	107
2019	16,952	706	-	1,002	16,369		1,381	16	85	**1,481**	1,680	-	**1,680**	**199**	108	93	80
2020	17,914	746	-	-	18,560		1,586	-	-	**1,586**	1,776	-	**1,776**	**190**	95	81	68
2021	18,934	789	94	-	19,899		1,696	-	-	**1,696**	1,877	8	**1,885**	**189**	88	73	61
2022	20,024	834	755	-	21,896		1,934	-	-	**1,934**	1,985	67	**2,052**	**118**	51	41	34
2023	21,180	883	1,262	-	23,654		2,072	-	-	**2,072**	2,100	111	**2,210**	**138**	55	44	35
2024	22,413	934	1,799	-	25,433		2,224	-	-	**2,224**	2,222	157	**2,379**	**155**	57	45	35
2025	23,723	988	1,547	-	26,692		2,364	-	-	**2,364**	2,352	137	**2,489**	**125**	42	33	26
TOTAL	**247,292**	**10,304**	**10,207**	**2,886**	**268,160**		**22,143**	**46**	**240**	**22,429**	**23,471**	**889.1**	**24,360**				
														NPV	**1,084**	**956**	**848**
														BC Ratio	**1.081**	**1.081**	**1.080**

Table 3.4.3: GHANA: Evaluation WITHOUT Interconnection Projects

BURKINA FASO																	
	ENERGY						COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation		Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	1,073	45	-	986	161		20	16	124	**161**	184	-	**184**	**24**	24	24	24
2012	1,146	48	-	1,110	117		13	18	120	**150**	197	-	**197**	**47**	43	43	42
2013	1,236	52	-	1,211	113		12	19	127	**159**	212	-	**212**	**53**	46	44	43
2014	1,339	56	-	1,355	80		9	22	157	**188**	230	-	**230**	**42**	33	31	30
2015	1,441	60	-	1,463	83		10	23	172	**205**	247	-	**247**	**42**	31	29	27
2016	1,556	65	-	1,583	85		10	25	189	**224**	267	-	**267**	**43**	29	27	24
2017	1,676	70	-	1,695	102		13	27	218	**258**	288	-	**288**	**29**	19	17	15
2018	1,803	75	-	1,792	140		20	29	253	**301**	310	-	**310**	**8**	5	4	4
2019	1,936	81	-	1,878	196		28	30	272	**331**	332	-	**332**	**2**	1	1	1
2020	2,080	87	-	1,919	310		37	31	229	**297**	357	-	**357**	**61**	30	26	22
2021	2,237	93	-	1,939	454		58	31	248	**337**	384	-	**384**	**47**	22	18	15
2022	2,400	100	-	1,928	634		90	31	274	**395**	412	-	**412**	**17**	7	6	5
2023	2,575	107	-	1,902	839		125	30	284	**440**	442	-	**442**	**2**	1	1	1
2024	2,762	115	-	1,864	1,069		165	30	287	**481**	474	-	**474**	**(7)**	(3)	(2)	(2)
2025	2,961	123	-	1,801	1,335		208	29	281	**519**	508	-	**508**	**(10)**	(4)	(3)	(2)
TOTAL	**28,222**	**1,176**	**-**	**24,426**	**5,718**		**798**	**375**	**3,111**	**4,284**	**4,660**	**-**	4,660				
														NPV	**285**	**265**	**247**
														BC Ratio	**1.118**	**1.125**	**1.132**

Table 3.4.4: BURKINA FASO: Evaluation WITHOUT Interconnection Projects

NIGER																	
	ENERGY						COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation		Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	650	27	-	679	0		0	11	59	**70**	60	-	**60**	**(10)**	(10)	(10)	(10)
2012	698	29	-	725	2		0	12	65	**77**	64	-	**64**	**(13)**	(12)	(12)	(11)
2013	748	31	-	771	8		1	12	70	**84**	69	-	**69**	**(15)**	(13)	(12)	(12)
2014	799	33	-	707	125		13	11	65	**89**	73	-	**73**	**(16)**	(12)	(12)	(11)
2015	972	40	-	130	889		96	2	12	**110**	89	-	**89**	**(20)**	(15)	(14)	(13)
2016	1,063	44	-	105	1,011		103	2	8	**114**	98	-	**98**	**(16)**	(11)	(10)	(9)
2017	1,464	61	-	222	1,311		178	4	16	**198**	135	-	**135**	**(63)**	(40)	(36)	(32)
2018	1,552	65	-	182	1,443		206	3	13	**222**	143	-	**143**	**(80)**	(47)	(41)	(36)
2019	1,641	68	82	-	1,809		310	-	-	**310**	151	14	**165**	**(146)**	(79)	(68)	(59)
2020	1,733	72	310	-	2,137		399	-	-	**399**	159	58	**217**	**(182)**	(91)	(77)	(66)
2021	1,828	76	606	-	2,540		499	-	-	**499**	168	119	**287**	**(212)**	(98)	(82)	(68)
2022	1,925	80	864	-	2,908		591	-	-	**591**	177	176	**353**	**(238)**	(102)	(84)	(69)
2023	2,025	84	1,073	-	3,227		661	-	-	**661**	186	220	**406**	**(255)**	(101)	(81)	(65)
2024	2,128	89	1,416	-	3,690		761	-	-	**761**	196	292	**488**	**(273)**	(101)	(79)	(63)
2025	2,234	93	1,480	-	3,866		803	-	-	**803**	205	307	**513**	**(290)**	(99)	(76)	(59)
TOTAL	**21,460**	**894**	**5,831**	**3,521**	**24,966**		**4,621**	**45**	**250**	**4,917**	**1,912**	**1,185.7**	**3,097**				
														NPV	**(830)**	**(694)**	**(583)**
														BC Ratio	**0.649**	**0.654**	**0.659**

Table 3.4.5: NIGER: Evaluation WITHOUT Interconnection Projects

NIGERIA																	
	ENERGY						COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation		Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	25,505	1,063	3,856	-	30,915		2,692	-	-	**2,692**	2,538	336	**2,874**	**182**	182	182	182
2012	29,072	1,211	4,012	-	34,876		3,124	-	-	**3,124**	2,893	359	**3,252**	**128**	119	117	115
2013	33,129	1,380	3,822	-	38,999		3,549	-	-	**3,549**	3,297	348	**3,645**	**96**	82	79	76
2014	37,756	1,573	708	-	40,677		3,726	-	-	**3,726**	3,757	65	**3,822**	**96**	76	72	69
2015	43,026	1,793	271	-	45,790		4,252	-	-	**4,252**	4,282	25	**4,307**	**55**	40	37	35
2016	49,031	2,043	783	-	52,714		4,201	-	-	**4,201**	4,879	62	**4,942**	**741**	504	460	420
2017	53,548	2,231	3,978	-	60,444		4,460	-	-	**4,460**	5,329	293	**5,622**	**1,162**	733	656	589
2018	58,469	2,436	2,890	-	64,475		4,691	-	-	**4,691**	5,818	210	**6,029**	**1,338**	781	687	605
2019	63,843	2,660	2,318	-	69,511		5,109	-	-	**5,109**	6,353	170	**6,524**	**1,415**	764	660	571
2020	69,702	2,904	-	62	73,186		5,458	1	5	**5,464**	6,936	-	**6,936**	**1,472**	737	624	531
2021	75,015	3,126	-	7	78,831		6,029	0	1	**6,029**	7,465	-	**7,465**	**1,436**	665	553	462
2022	81,884	3,412	-	1,051	84,962		6,641	17	82	**6,740**	8,149	-	**8,149**	**1,409**	604	494	405
2023	89,379	3,724	-	1,300	92,571		7,403	21	104	**7,527**	8,894	-	**8,894**	**1,367**	543	436	351
2024	97,548	4,065	-	1,586	100,847		8,233	25	129	**8,387**	9,707	-	**9,707**	**1,320**	485	382	302
2025	106,084	4,420	-	1,625	109,753		9,120	26	135	**9,281**	10,557	-	**10,557**	**1,275**	434	336	261
TOTAL	**912,991**	**38,041**	**22,640**	**5,631**	**978,553**		**75,995**	**90**	**456**	76,541	**88,317**	**1,534**	89,850				
														NPV	**6,749**	**5,776**	**4,975**
														BC Ratio	**1.155**	**1.151**	**1.146**

Table 3.4.6: NIGERIA: Evaluation WITHOUT Interconnection Projects

COTE D'IVOIRE																	
	ENERGY						COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation		Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	5,932	247	433	-	6,731		656	-	-	**656**	769	42	**811**	**155**	155	155	155
2012	6,312	263	1,557	-	8,276		741	-	-	**741**	818	139	**957**	**216**	200	197	193
2013	6,716	280	289	-	7,420		612	-	-	**612**	870	24	**894**	**282**	242	233	225
2014	7,158	298	-	1,075	6,527		518	17	85	**621**	928	-	**928**	**307**	244	231	218
2015	7,642	318	-	876	7,240		575	14	70	**659**	990	-	**990**	**332**	244	227	211
2016	8,101	338	2,142	-	10,770		867	-	-	**867**	1,050	173	**1,222**	**355**	242	220	201
2017	8,579	357	1,657	-	10,770		867	-	-	**867**	1,112	133	**1,245**	**378**	238	213	191
2018	9,070	378	4,016	-	13,831		1,036	-	-	**1,036**	1,175	301	**1,476**	**440**	257	226	199
2019	9,584	399	3,534	-	13,869		1,039	-	-	**1,039**	1,242	265	**1,507**	**468**	253	218	189
2020	10,124	422	3,397	-	14,292		1,075	-	-	**1,075**	1,312	255	**1,567**	**493**	246	209	178
2021	10,675	445	2,883	-	14,333		1,077	-	-	**1,077**	1,383	217	**1,600**	**523**	242	202	168
2022	11,257	469	2,341	-	14,377		1,080	-	-	**1,080**	1,459	176	**1,635**	**555**	238	194	160
2023	11,852	494	1,782	-	14,422		1,082	-	-	**1,082**	1,536	134	**1,670**	**587**	233	187	151
2024	12,477	520	1,263	-	14,549		1,092	-	-	**1,092**	1,617	95	**1,712**	**619**	228	179	142
2025	13,126	547	726	-	14,684		1,103	-	-	**1,103**	1,701	55	**1,756**	**653**	222	172	134
TOTAL	**138,606**	**5,775**	**26,020**	**1,951**	**172,091**		**12,766**	**31**	**155**	**12,952**	**17,194**	**1,966**	**19,160**				
														NPV	**3,483**	**3,063**	**2,714**
														BC Ratio	**1.443**	**1.438**	**1.432**

Table 3.4.7: COTE d'IVOIRE: Evaluation WITHOUT Interconnection Projects

TOGO																	
	ENERGY						COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation		Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	1,041	43	-	945	193		13	15	65	**93**	113	-	**113**	**20**	20	20	20
2012	1,293	54	-	1,209	185		12	19	79	**110**	140	-	**140**	**30**	28	27	27
2013	1,439	60	-	1,358	171		10	22	81	**113**	156	-	**156**	**43**	37	36	34
2014	1,570	65	-	1,492	175		11	24	92	**127**	170	-	**170**	**44**	35	33	31
2015	1,711	71	-	1,641	176		11	26	102	**139**	186	-	**186**	**47**	35	32	30
2016	1,872	78	-	1,546	442		46	25	162	**233**	203	-	**203**	**(30)**	(20)	(18)	(17)
2017	2,044	85	-	1,728	442		46	28	181	**255**	222	-	**222**	**(33)**	(21)	(19)	(17)
2018	2,228	93	-	1,921	443		46	31	201	**279**	242	-	**242**	**(37)**	(21)	(19)	(17)
2019	2,424	101	-	1,735	836		99	28	205	**332**	263	-	**263**	**(68)**	(37)	(32)	(28)
2020	2,607	109	-	963	1,803		227	15	121	**364**	283	-	**283**	**(81)**	(41)	(34)	(29)
2021	2,799	117	-	1,008	1,962		249	16	128	**392**	304	-	**304**	**(88)**	(41)	(34)	(28)
2022	3,002	125	-	873	2,311		295	14	111	**420**	326	-	**326**	**(95)**	(41)	(33)	(27)
2023	3,215	134	-	849	2,561		328	14	109	**451**	349	-	**349**	**(102)**	(40)	(32)	(26)
2024	3,440	143	-	887	2,761		355	14	114	**483**	373	-	**373**	**(110)**	(40)	(32)	(25)
2025	3,677	153	-	637	3,260		410	10	80	**500**	399	-	**399**	**(101)**	(34)	(26)	(21)
TOTAL	**34,364**	**1,432**	**-**	**18,790**	**17,723**		**2,146**	**286**	**1,766**	**4,197**	**3,618**	**-**	3,618				
														NPV	**(182)**	**(132)**	**(92)**
														BC Ratio	**0.918**	**0.932**	**0.945**

Table 3.4.8: TOGO: Evaluation WITHOUT Interconnection Projects

BENIN																	
	ENERGY						COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation		Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	1,340	56	-	1,433	193		28	23	113	**164**	167	-	**167**	**3**	3	3	3
2012	1,468	61	-	1,607	185		27	26	116	**169**	183	-	**183**	**14**	13	12	12
2013	1,563	65	-	1,694	171		25	27	118	**170**	195	-	**195**	**24**	21	20	19
2014	1,696	71	-	-	175		17	-	-	**17**	211	-	**211**	**195**	155	146	139
2015	1,834	76	-	-	176		17	-	-	**17**	228	-	**228**	**212**	156	145	135
2016	1,967	82	-	966	442		42	15	298	**355**	245	-	**245**	**(110)**	(75)	(68)	(63)
2017	2,104	88	-	2,203	442		42	35	50	**127**	262	-	**262**	**135**	85	76	68
2018	2,247	94	-	1,230	443		42	20	89	**151**	280	-	**280**	**129**	75	66	58
2019	2,395	100	-	981	836		79	16	72	**167**	298	-	**298**	**132**	71	61	53
2020	2,575	107	-	571	1,803		160	9	519	**689**	321	-	**321**	**(368)**	(184)	(156)	(133)
2021	2,765	115	-	630	1,962		175	10	76	**261**	344	-	**344**	**83**	39	32	27
2022	2,965	124	-	295	2,311		209	5	295	**508**	369	-	**369**	**(139)**	(60)	(49)	(40)
2023	3,176	132	-	293	2,561		232	5	293	**530**	396	-	**396**	**(134)**	(53)	(43)	(34)
2024	3,398	142	-	312	2,761		251	5	312	**568**	423	-	**423**	**(144)**	(53)	(42)	(33)
2025	3,632	151	-	8	3,260		297	0	8	**306**	452	-	**452**	**147**	50	39	30
TOTAL	**35,123**	**1,463**	**-**	**12,221**	**17,723**		**1,613**	**173**	**2,248**	**4,033**	**4,208**	**-**	4,208				
														NPV	**242**	**243**	**242**
														BC Ratio	**1.110**	**1.127**	**1.144**

Table 3.4.9: BENIN: Evaluation WITHOUT Interconnection Projects

SENEGAL																	
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL			Present Worth ($M)		
															8%	10%	12%
2011	2,670	111	-	603	2,178	319	-	94	**413**	451	-	**451**		**38**	38	38	38
2012	2,986	124	-	748	2,363	346	-	119	**464**	505	-	**505**		**40**	37	37	36
2013	3,115	130	-	1,032	2,213	324	-	154	**478**	526	-	**526**		**49**	42	40	39
2014	3,261	136	249	-	3,657	660	-	-	**660**	551	45	**596**		**(64)**	(51)	(48)	(46)
2015	3,683	153	-	168	3,668	662	-	24	**687**	622	-	**622**		**(64)**	(47)	(44)	(41)
2016	4,239	177	1,135	-	5,596	1,362	-	-	**1,362**	716	276	**993**		**(369)**	(251)	(229)	(210)
2017	4,456	186	1,037	-	5,719	1,408	-	-	**1,408**	753	255	**1,008**		**(399)**	(252)	(225)	(202)
2018	4,690	195	562	-	5,470	1,379	-	-	**1,379**	793	142	**934**		**(444)**	(259)	(228)	(201)
2019	4,941	206	426	-	5,591	1,407	-	-	**1,407**	835	107	**942**		**(465)**	(251)	(217)	(188)
2020	5,217	217	490	-	5,943	1,504	-	-	**1,504**	882	124	**1,006**		**(498)**	(249)	(211)	(180)
2021	5,527	230	654	-	6,437	1,639	-	-	**1,639**	934	167	**1,101**		**(539)**	(249)	(208)	(173)
2022	5,831	243	817	-	6,924	1,773	-	-	**1,773**	986	209	**1,195**		**(578)**	(248)	(203)	(166)
2023	6,153	256	969	-	7,418	1,909	-	-	**1,909**	1,040	249	**1,289**		**(620)**	(246)	(197)	(159)
2024	6,499	271	1,119	-	7,933	2,051	-	-	**2,051**	1,098	289	**1,388**		**(663)**	(244)	(192)	(152)
2025	6,862	286	1,187	-	8,382	2,173	-	-	**2,173**	1,160	308	**1,467**		**(705)**	(240)	(186)	(144)
TOTAL	**70,129**	**2,922**	**8,645**	**2,551**	**79,491**	**18,597**	**-**	**297**	**18,894**	**11,402**	**2,171.5**	**13,573**					
														NPV	**(2,472)**	**(2,074)**	**(1,749)**
														BC Ratio	**0.757**	**0.766**	**0.775**

Table 3.4.10: SENEGAL: Evaluation WITHOUT Interconnection Projects

MALI																	
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL			Present Worth ($M)		
															8%	10%	12%
2011	1,199	50	603	-	1,882	294	-	-	**294**	249	94	**343**		**49**	49	49	49
2012	1,301	54	748	-	2,133	338	-	-	**338**	270	119	**388**		**50**	47	46	45
2013	1,457	61	1,032	-	2,591	387	-	-	**387**	302	154	**456**		**69**	59	57	55
2014	2,212	92	-	249	2,087	302	-	36	**338**	459	-	**459**		**121**	96	91	86
2015	2,332	97	168	-	2,619	380	-	-	**380**	484	24	**508**		**128**	94	88	82
2016	3,026	126	-	1,135	2,062	263	-	145	**408**	628	-	**628**		**220**	150	137	125
2017	3,132	131	-	1,037	2,277	274	-	125	**399**	650	-	**650**		**250**	158	141	127
2018	3,297	137	-	562	2,929	319	-	61	**380**	684	-	**684**		**304**	177	156	137
2019	3,397	142	-	426	3,171	344	-	46	**390**	705	-	**705**		**315**	170	147	127
2020	3,554	148	-	490	3,276	351	-	52	**403**	737	-	**737**		**334**	167	142	120
2021	3,731	155	-	654	3,300	354	-	70	**424**	774	-	**774**		**350**	162	135	113
2022	3,911	163	-	817	3,329	358	-	88	**446**	811	-	**811**		**365**	157	128	105
2023	4,096	171	-	969	3,373	365	-	105	**469**	850	-	**850**		**380**	151	121	98
2024	4,285	179	-	1,119	3,423	373	-	122	**494**	889	-	**889**		**394**	145	114	90
2025	4,478	187	-	1,187	3,557	394	-	132	**526**	929	-	**929**		**403**	137	106	82
TOTAL	**45,409**	**1,892**	**2,551**	**8,645**	**42,008**	**4,801**	**-**	**982**	**5,782**	**9,170**	**297.1**	**9,467**					
														NPV	**1,919**	**1,657**	**1,442**
														BC Ratio	**1.535**	**1.516**	**1.497**

Table 3.4.11: MALI: Evaluation WITHOUT Interconnection Projects

LIBERIA																	
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL			Present Worth ($M)		
															8%	10%	12%
2011	53	2	-	-	55	13	-	-	**13**	12	-	**12**		**(1)**	(1)	(1)	(1)
2012	117	5	-	-	122	28	-	-	**28**	27	-	**27**		**(1)**	(1)	(1)	(1)
2013	181	8	-	-	189	42	-	-	**42**	42	-	**42**		**0**	0	0	0
2014	252	10	-	-	262	59	-	-	**59**	58	-	**58**		**(1)**	(0)	(0)	(0)
2015	293	12	-	-	305	31	-	-	**31**	68	-	**68**		**36**	27	25	23
2016	310	13	-	-	323	33	-	-	**33**	72	-	**72**		**39**	26	24	22
2017	328	14	-	-	342	34	-	-	**34**	76	-	**76**		**42**	26	23	21
2018	351	15	-	-	366	36	-	-	**36**	81	-	**81**		**45**	27	23	21
2019	369	15	-	-	384	37	-	-	**37**	85	-	**85**		**48**	26	23	20
2020	398	17	-	-	415	38	-	-	**38**	92	-	**92**		**53**	27	23	19
2021	422	18	-	-	439	40	-	-	**40**	97	-	**97**		**57**	27	22	18
2022	451	19	-	-	470	42	-	-	**42**	104	-	**104**		**62**	27	22	18
2023	480	20	-	-	500	43	-	-	**43**	111	-	**111**		**67**	27	21	17
2024	509	21	-	-	531	45	-	-	**45**	118	-	**118**		**72**	27	21	17
2025	544	23	-	-	567	47	-	-	**47**	126	-	**126**		**78**	27	21	16
TOTAL	**5,059**	**211**	**-**	**-**	**5,269**	**555**	**-**	**-**	**555**	**1,155**	**-**	**1,155**					
														NPV	**290**	**246**	**210**
														BC Ratio	**1.868**	**1.822**	**1.779**

Table 3.4.12: LIBERIA: Evaluation WITHOUT Interconnection Projects

SIERRA LEONE																	
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL			Present Worth ($M)		
															8%	10%	12%
2011	223	9	-	-	232	14	-	-	**14**	51	-	**51**		**38**	38	38	38
2012	293	12	-	-	305	19	-	-	**19**	68	-	**68**		**49**	45	44	44
2013	398	17	-	-	415	33	-	-	**33**	92	-	**92**		**59**	50	49	47
2014	533	22	-	-	555	54	-	-	**54**	123	-	**123**		**69**	55	52	49
2015	644	27	-	-	671	48	-	-	**48**	149	-	**149**		**101**	74	69	64
2016	784	33	-	-	817	69	-	-	**69**	181	-	**181**		**112**	76	69	63
2017	867	36	-	-	903	45	-	-	**45**	200	-	**200**		**155**	98	88	79
2018	907	38	-	-	945	47	-	-	**47**	209	-	**209**		**162**	94	83	73
2019	948	40	-	-	988	50	-	-	**50**	219	-	**219**		**168**	91	79	68
2020	996	41	-	-	1,037	55	-	-	**55**	230	-	**230**		**175**	88	74	63
2021	1,048	44	-	-	1,092	59	-	-	**59**	242	-	**242**		**183**	85	70	59
2022	1,101	46	-	-	1,147	64	-	-	**64**	254	-	**254**		**190**	81	67	55
2023	1,160	48	-	-	1,208	69	-	-	**69**	268	-	**268**		**198**	79	63	51
2024	1,212	50	-	-	1,262	74	-	-	**74**	279	-	**279**		**205**	75	59	47
2025	1,270	53	-	-	1,323	80	-	-	**80**	293	-	**293**		**213**	73	56	44
TOTAL	**12,384**	**516**	**-**	**-**	**12,899**	**766**	**-**	**-**	**766**	**2,805**	**-**	**2,805**					
														NPV	**1,102**	**960**	**843**
														BC Ratio	**3.555**	**3.528**	**3.500**

Table 3.4.13: SIERRA LEONE: Evaluation WITHOUT Interconnection Projects

GUINEA																	
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL			Present Worth ($M)		
															8%	10%	12%
2011	814	34	-	-	848	71	-	-	**71**	68	-	**68**		**(3)**	(3)	(3)	(3)
2012	960	40	-	-	1,000	102	-	-	**102**	81	-	**81**		**(21)**	(19)	(19)	(19)
2013	1,113	46	-	-	1,159	132	-	-	**132**	94	-	**94**		**(38)**	(33)	(32)	(31)
2014	1,294	54	-	-	1,348	165	-	-	**165**	109	-	**109**		**(56)**	(44)	(42)	(40)
2015	1,569	65	-	-	1,634	198	-	-	**198**	132	-	**132**		**(66)**	(48)	(45)	(42)
2016	1,768	74	-	-	1,842	234	-	-	**234**	149	-	**149**		**(85)**	(58)	(53)	(48)
2017	1,820	76	-	-	1,896	120	-	-	**120**	153	-	**153**		**33**	21	19	17
2018	1,877	78	-	-	1,955	127	-	-	**127**	158	-	**158**		**31**	18	16	14
2019	1,933	81	-	-	2,014	111	-	-	**111**	163	-	**163**		**52**	28	24	21
2020	1,991	83	-	-	2,074	93	-	-	**93**	168	-	**168**		**74**	37	32	27
2021	2,089	87	-	-	2,176	96	-	-	**96**	176	-	**176**		**80**	37	31	26
2022	2,157	90	-	-	2,247	98	-	-	**98**	181	-	**181**		**84**	36	29	24
2023	2,232	93	-	-	2,325	101	-	-	**101**	188	-	**188**		**87**	35	28	22
2024	2,301	96	-	-	2,397	104	-	-	**104**	194	-	**194**		**90**	33	26	21
2025	2,370	99	-	-	2,469	105	-	-	**105**	199	-	**199**		**94**	32	25	19
TOTAL	**26,289**	**1,095**	**-**	**-**	**27,385**	**1,783**	**-**	**-**	1,783	**2,143**	**-**	2,143					
														NPV	**72**	**36**	**9**
														BC Ratio	**1.061**	**1.034**	**1.009**

Table 3.4.14: GUINEA: Evaluation WITHOUT Interconnection Projects

GUINEA BISSAU																
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL			Present Worth ($M)		
															8%	10%	12%
2011	172	7	-	-	179	41	-	-	**41**	28	-	**28**		**(13)**	(13)	(13)	(13)
2012	188	8	-	-	196	45	-	-	**45**	31	-	**31**		**(14)**	(13)	(13)	(13)
2013	199	8	-	-	207	48	-	-	**48**	33	-	**33**		**(15)**	(13)	(13)	(12)
2014	210	9	-	-	219	51	-	-	**51**	34	-	**34**		**(16)**	(13)	(12)	(11)
2015	223	9	-	-	232	53	-	-	**53**	36	-	**36**		**(17)**	(12)	(11)	(11)
2016	236	10	-	-	245	55	-	-	**55**	39	-	**39**		**(17)**	(11)	(10)	(9)
2017	293	12	-	-	305	64	-	-	**64**	48	-	**48**		**(16)**	(10)	(9)	(8)
2018	354	15	-	-	369	72	-	-	**72**	58	-	**58**		**(14)**	(8)	(7)	(6)
2019	418	17	-	-	436	72	-	-	**72**	69	-	**69**		**(3)**	(2)	(2)	(1)
2020	486	20	-	-	506	72	-	-	**72**	80	-	**80**		**8**	4	3	3
2021	556	23	-	-	580	72	-	-	**72**	91	-	**91**		**19**	9	7	6
2022	587	24	-	-	611	72	-	-	**72**	96	-	**96**		**24**	10	9	7
2023	619	26	-	-	644	72	-	-	**72**	101	-	**101**		**30**	12	9	8
2024	652	27	-	-	679	72	-	-	**72**	107	-	**107**		**35**	13	10	8
2025	687	29	-	-	715	72	-	-	**72**	113	-	**113**		**41**	14	11	8
TOTAL	**5,878**	**245**	**-**	**-**	**6,123**	**890**	**-**	**-**	**890**	**936**	**-**	**936**					
														NPV	**(33)**	**(40)**	**(45)**
														BC Ratio	**0.938**	**0.917**	**0.897**

Table 3.4.14: GUINEA BISSAU: Evaluation WITHOUT Interconnection Projects

GAMBIA																	
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL			Present Worth ($M)		
															8%	10%	12%
2011	293	12	-	-	305	70	-	-	**70**	48	-	**48**		**(22)**	(22)	(22)	(22)
2012	357	15	-	-	372	86	-	-	**86**	59	-	**59**		**(27)**	(25)	(25)	(24)
2013	410	17	-	-	427	97	-	-	**97**	67	-	**67**		**(30)**	(26)	(25)	(24)
2014	463	19	-	-	482	110	-	-	**110**	76	-	**76**		**(34)**	(27)	(25)	(24)
2015	550	23	-	-	573	131	-	-	**131**	90	-	**90**		**(41)**	(30)	(28)	(26)
2016	697	29	-	-	726	105	-	-	**105**	114	-	**114**		**9**	6	6	5
2017	720	30	-	-	750	111	-	-	**111**	118	-	**118**		**8**	5	4	4
2018	744	31	-	-	775	116	-	-	**116**	122	-	**122**		**6**	3	3	3
2019	767	32	-	-	799	122	-	-	**122**	126	-	**126**		**4**	2	2	2
2020	790	33	-	-	823	127	-	-	**127**	130	-	**130**		**2**	1	1	1
2021	826	34	-	-	860	136	-	-	**136**	135	-	**135**		**(1)**	(0)	(0)	(0)
2022	855	36	-	-	890	143	-	-	**143**	140	-	**140**		**(3)**	(1)	(1)	(1)
2023	884	37	-	-	921	150	-	-	**150**	145	-	**145**		**(5)**	(2)	(2)	(1)
2024	919	38	-	-	958	158	-	-	**158**	151	-	**151**		**(8)**	(3)	(2)	(2)
2025	954	40	-	-	994	167	-	-	**167**	157	-	**157**		**(10)**	(3)	(3)	(2)
TOTAL	**10,228**	**426**	**-**	**-**	**10,655**	**1,758**	**-**	**-**	1,758	**1,629**	**-**	1,629					
														NPV	**(122)**	**(117)**	**(112)**
														BC Ratio	**0.884**	**0.876**	**0.867**

Table 3.4.14: GAMBIA: Evaluation WITHOUT Interconnection Projects

APPENDIX 3.5: FINANCIAL EVALUATION OF COUNTRIES (WITH PROJECTS CASE)

ALL COUNTRIES (ZONE A)																			
	ENERGY								NET BENEFITS										
	NET DOMESTIC ENERGY SALES																Present Worth		
	Ghana	Burkina Faso	Niger	Nigeria	Cote d'Ivoire	Togo	Benin	TOTAL	Ghana	Burkina Faso	Niger	Nigeria	Cote d'Ivoire	Togo	Benin		TOTAL	8%	10%	12%
2011	10,516	1,073	650	25,505	5,932	1,041	1,340	**46,058**	235	(7)	(59)	432	155	(24)	(26)	-	**707**	707	707	707
2012	11,123	1,146	698	29,072	6,312	1,293	1,468	**51,111**	352	82	10	597	201	(47)	236	-	**1,432**	1,326	1,302	1,279
2013	12,265	1,236	748	33,129	6,716	1,439	1,563	**57,097**	394	99	8	589	245	40	60	-	**1,435**	1,230	1,186	1,144
2014	12,943	1,339	799	37,756	7,158	1,570	1,696	**63,260**	163	123	6	671	271	23	355	-	**1,612**	1,280	1,211	1,148
2015	13,640	1,441	972	43,026	7,642	1,711	1,834	**70,266**	128	105	14	728	339	25	519	-	**1,857**	1,365	1,268	1,180
2016	14,408	1,556	1,063	49,031	8,101	1,872	1,967	**77,998**	235	136	19	861	358	46	358	-	**2,012**	1,370	1,250	1,142
2017	15,202	1,676	1,464	53,548	8,579	2,044	2,104	**84,619**	250	148	(29)	800	384	47	373	-	**1,973**	1,243	1,114	999
2018	16,054	1,803	1,552	58,469	9,070	2,228	2,247	**91,422**	292	156	(24)	1,489	654	52	358	-	**2,977**	1,737	1,527	1,346
2019	16,952	1,936	1,641	63,843	9,584	2,424	2,395	**98,775**	345	175	(2)	1,659	677	75	367	-	**3,296**	1,781	1,538	1,331
2020	17,914	2,080	1,733	69,702	10,124	2,607	2,575	**106,734**	368	230	(2)	1,796	707	79	357	-	**3,535**	1,768	1,499	1,275
2021	18,934	2,237	1,828	75,015	10,675	2,799	2,765	**114,253**	355	269	(30)	1,903	736	95	380	-	**3,708**	1,718	1,430	1,194
2022	20,024	2,400	1,925	81,884	11,257	3,002	2,965	**123,458**	340	249	(259)	1,978	768	259	383	-	**3,718**	1,595	1,303	1,069
2023	21,180	2,575	2,025	89,379	11,852	3,215	3,176	**133,402**	333	250	(269)	2,114	800	282	390	-	**3,899**	1,548	1,242	1,001
2024	22,413	2,762	2,128	97,548	12,477	3,440	3,398	**144,166**	316	276	(280)	2,204	834	45	395	-	**3,790**	1,394	1,098	869
2025	23,723	2,961	2,234	106,084	13,126	3,677	3,632	**155,438**	339	312	(287)	2,354	866	37	411	-	**4,031**	1,372	1,062	825
TOTAL	**247,292**	**28,222**	**21,460**	**912,990**	**138,606**	**34,364**	**35,123**		**4,446**	**2,605**	**(1,185)**	**20,175**	**7,993**					-	-	-
																	NPV	**21,433**	**18,736**	**16,508**
																	BC Ratio	**1.324**	**1.321**	**1.317**

Table 3.5.1: ZONE A COUNTRIES: Evaluation WITH Interconnection Projects

GHANA																	
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales		TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	10,516	438	-	1,232	9,759	717	18	124	**859**	1,042	-		**1,042**	**183**	183	183	183
2012	11,123	463	-	1,585	10,040	648	23	140	**812**	1,103	-		**1,103**	**291**	269	264	260
2013	12,265	511	-	2,297	10,521	675	34	192	**900**	1,216	-		**1,216**	**316**	271	261	252
2014	12,943	539	727	3,009	12,860	951	44	-	**996**	1,283	54		**1,337**	**341**	271	256	243
2015	13,640	568	2,043	3,009	14,963	1,150	44	-	**1,195**	1,352	157		**1,509**	**314**	231	215	200
2016	14,408	600	3,995	3,009	16,278	1,270	44	-	**1,315**	1,428	312		**1,740**	**425**	289	264	241
2017	15,202	633	3,183	3,009	16,278	1,270	44	-	**1,315**	1,507	248		**1,755**	**441**	278	249	223
2018	16,054	669	719	3,009	14,674	1,124	44	-	**1,169**	1,591	55		**1,647**	**478**	279	245	216
2019	16,952	706	-	4,012	13,807	1,035	59	74	**1,168**	1,680	-		**1,680**	**512**	277	239	207
2020	17,914	746	-	4,967	13,813	1,036	73	145	**1,254**	1,776	-		**1,776**	**522**	261	221	188
2021	18,934	789	-	4,344	15,483	1,188	64	78	**1,331**	1,877	-		**1,877**	**546**	253	211	176
2022	20,024	834	-	3,788	17,235	1,348	56	37	**1,441**	1,985	-		**1,985**	**544**	233	191	156
2023	21,180	883	-	3,253	18,979	1,508	48	12	**1,568**	2,100	-		**2,100**	**531**	211	169	136
2024	22,413	934	1,012	3,009	21,543	1,744	44	-	**1,788**	2,222	82		**2,304**	**515**	189	149	118
2025	23,723	988	-	3,141	21,694	1,758	46	6	**1,811**	2,352	-		**2,352**	**541**	184	142	111
TOTAL	**247,292**	**10,304**	**11,679**	**46,670**	**227,925**	**16,706**	**672**	**684**	18,061	**23,471**	**908.0**		24,379				
														NPV	**3,680**	**3,260**	**2,911**
														BC Ratio	**1.339**	**1.338**	**1.336**

Table 3.5.2: GHANA: Evaluation WITH Interconnection Projects

BURKINA FASO																	
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales		TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	1,073	45	73	-	1,201	203	-	-	**203**	184	12		**197**	**(7)**	(7)	(7)	(7)
2012	1,146	48	-	1,110	117	13	16	102	**131**	197	-		**197**	**66**	61	60	59
2013	1,236	52	-	362	113	12	5	101	**118**	212	-		**212**	**94**	81	78	75
2014	1,339	56	-	572	57	5	8	101	**115**	230	-		**230**	**115**	91	86	82
2015	1,441	60	-	1,462	57	5	22	138	**164**	247	-		**247**	**83**	61	57	53
2016	1,556	65	-	1,608	57	5	24	125	**154**	267	-		**267**	**113**	77	70	64
2017	1,676	70	-	1,724	57	5	25	135	**165**	288	-		**288**	**123**	77	69	62
2018	1,803	75	-	392	57	5	6	148	**159**	310	-		**310**	**150**	88	77	68
2019	1,936	81	-	2,126	4	0	31	157	**189**	332	-		**332**	**143**	77	67	58
2020	2,080	87	-	2,280	7	1	34	126	**161**	357	-		**357**	**196**	98	83	71
2021	2,237	93	-	2,415	4	0	36	114	**150**	384	-		**384**	**234**	108	90	75
2022	2,400	100	-	2,612	0	0	39	163	**202**	412	-		**412**	**210**	90	74	60
2023	2,575	107	-	2,749	15	3	41	189	**233**	442	-		**442**	**209**	83	67	54
2024	2,762	115	-	1,012	20	3	15	194	**213**	474	-		**474**	**261**	96	76	60
2025	2,961	123	-	3,104	30	5	46	191	**242**	508	-		**508**	**267**	91	70	55
TOTAL	**28,222**	**1,176**	**73**	**23,528**	**1,795**	**63**	**348**	**1,986**	**2,397**	**4,660**	**-**		**4,660**				
														NPV	**1,173**	**1,017**	**888**
														BC Ratio	**1.766**	**1.740**	**1.715**

Table 3.5.3: BURKINA FASO: Evaluation WITH Interconnection Projects

NIGER																	
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales		TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	650	27	-	677	0	0	10	53	**63**	60	-		**60**	**(3)**	(3)	(3)	(3)
2012	698	29	-	725	2	0	11	54	**65**	64	-		**64**	**(1)**	(1)	(1)	(1)
2013	748	31	-	771	8	1	11	59	**72**	69	-		**69**	**(3)**	(3)	(3)	(3)
2014	799	33	-	707	125	13	10	55	**78**	73	-		**73**	**(4)**	(4)	(3)	(3)
2015	972	40	-	278	736	53	4	22	**79**	89	-		**89**	**10**	7	7	6
2016	1,063	44	-	326	736	53	5	25	**84**	98	-		**98**	**14**	10	9	8
2017	1,464	61	-	551	976	119	8	44	**172**	135	-		**135**	**(37)**	(23)	(21)	(19)
2018	1,552	65	-	562	1,085	125	8	42	**175**	143	-		**143**	**(33)**	(19)	(17)	(15)
2019	1,641	68	-	583	1,087	126	9	27	**161**	151	-		**151**	**(10)**	(6)	(5)	(4)
2020	1,733	72	-	745	1,088	126	11	35	**172**	159	-		**159**	**(13)**	(6)	(5)	(5)
2021	1,828	76	-	181	1,088	126	3	72	**201**	168	-		**168**	**(33)**	(15)	(13)	(11)
2022	1,925	80	488	-	2,587	538	-	-	**538**	177	101		**278**	**(259)**	(111)	(91)	(75)
2023	2,025	84	395	-	2,587	538	-	-	**538**	186	82		**268**	**(269)**	(107)	(86)	(69)
2024	2,128	89	299	-	2,589	538	-	-	**538**	196	62		**258**	**(280)**	(103)	(81)	(64)
2025	2,234	93	218	-	2,589	538	-	-	**538**	205	45		**251**	**(287)**	(98)	(76)	(59)
TOTAL	**21,460**	**894**	**1,400**	**6,106**	**17,282**	**2,895**	**80**	**434**	3,409	**1,912**	**290.9**		2,203				
														NPV	**(482)**	**(389)**	**(315)**
														BC Ratio	**0.710**	**0.725**	**0.741**

Table 3.5.4: NIGER: Evaluation WITH Interconnection Projects

NIGERIA																	
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales		TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	25,505	1,063	3,629	-	30,678	2,388	-	-	**2,388**	2,538	282		**2,821**	**432**	432	432	432
2012	29,072	1,211	3,784	-	34,639	2,577	-	-	**2,577**	2,893	282		**3,175**	**597**	553	543	533
2013	33,129	1,380	5,151	-	40,381	3,104	-	-	**3,104**	3,297	396		**3,693**	**589**	505	487	469
2014	37,756	1,573	1,832	-	41,847	3,228	-	-	**3,228**	3,757	141		**3,898**	**671**	533	504	478
2015	43,026	1,793	2,011	-	47,606	3,710	-	-	**3,710**	4,282	157		**4,438**	**728**	535	497	463
2016	49,031	2,043	2,922	-	54,627	4,246	-	-	**4,246**	4,879	227		**5,106**	**861**	586	534	488
2017	53,548	2,231	3,704	-	61,575	4,818	-	-	**4,818**	5,329	290		**5,619**	**800**	504	452	406
2018	58,469	2,436	607	-	62,107	4,130	-	-	**4,130**	5,818	40		**5,859**	**1,729**	1,009	887	782
2019	63,843	2,660	594	-	67,753	4,609	-	-	**4,609**	6,353	40		**6,394**	**1,784**	964	832	721
2020	69,702	2,904	710	-	74,093	5,133	-	-	**5,133**	6,936	49		**6,985**	**1,852**	926	785	668
2021	75,015	3,126	635	-	79,674	5,590	-	-	**5,590**	7,465	45		**7,509**	**1,919**	889	740	618
2022	81,884	3,412	-	3,170	82,877	5,874	47	225	**6,145**	8,149	-		**8,149**	**2,003**	859	702	576
2023	89,379	3,724	-	2,978	91,053	6,546	44	214	**6,804**	8,894	-		**8,894**	**2,091**	830	666	537
2024	97,548	4,064	-	2,844	99,888	7,298	42	208	**7,548**	9,707	-		**9,707**	**2,159**	794	625	495
2025	106,084	4,420	-	1,842	109,754	8,182	27	137	**8,346**	10,557	-		**10,557**	**2,211**	753	582	452
TOTAL	**912,990**	**38,041**	**25,579**	**10,834**	**978,552**	**69,045**	**160**	**784**	69,989	**88,317**	**1,667**		**89,984**				
														NPV	**10,672**	**9,271**	**8,118**
														BC Ratio	**1.269**	**1.265**	**1.262**

Table 3.5.5: NIGERIA: Evaluation WITH Interconnection Projects

COTE D'IVOIRE																	
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales		TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	5,932	247	1,055	-	7,316	717	-	-	**717**	769	103		**872**	**155**	155	155	155
2012	6,312	263	2,138	-	8,870	813	-	-	**813**	818	196		**1,014**	**201**	186	183	179
2013	6,716	280	2,247	-	9,397	823	-	-	**823**	870	197		**1,067**	**245**	210	202	195
2014	7,158	298	-	225	7,566	602	3	55	**660**	928	-		**928**	**267**	212	201	190
2015	7,642	318	1,253	80	9,347	745	1	6	**753**	990	100		**1,090**	**338**	248	231	215
2016	8,101	338	1,834	-	10,471	839	-	-	**839**	1,050	147		**1,197**	**358**	243	222	203
2017	8,579	357	1,386	-	10,471	839	-	-	**839**	1,112	111		**1,223**	**384**	242	216	194
2018	9,070	378	4,139	-	11,204	828	-	-	**828**	1,175	306		**1,481**	**654**	381	335	296
2019	9,584	399	4,979	-	12,619	933	-	-	**933**	1,242	368		**1,610**	**677**	366	316	274
2020	10,124	422	5,316	-	13,491	998	-	-	**998**	1,312	393		**1,705**	**707**	354	300	255
2021	10,675	445	4,797	-	13,554	1,002	-	-	**1,002**	1,383	355		**1,738**	**736**	341	284	237
2022	11,257	469	4,924	-	14,274	1,055	-	-	**1,055**	1,459	364		**1,823**	**768**	329	269	221
2023	11,852	494	4,425	14	14,385	1,063	0	-	**1,063**	1,536	327		**1,863**	**800**	318	255	205
2024	12,477	520	3,794	-	14,385	1,063	-	-	**1,063**	1,617	280		**1,897**	**834**	307	242	191
2025	13,126	547	3,078	-	14,385	1,063	-	-	**1,063**	1,701	227		**1,928**	**866**	295	228	177
TOTAL	**138,606**	**5,775**	**45,366**	**319**	**171,734**	**12,666**	**5**	**61**	**12,732**	**17,194**	**3,371**		**20,565**				
														NPV	**4,187**	**3,639**	**3,187**
														BC Ratio	**1.528**	**1.512**	**1.497**

Table 3.5.5: COTE d'IVOIRE: Evaluation WITH Interconnection Projects

TOGO																	
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales		TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	1,041	43	-	329	824	98	5	39	**142**	113	-		**113**	**(29)**	(29)	(29)	(29)
2012	1,293	54	-	1,158	227	14	17	74	**105**	140	-		**140**	**35**	32	32	31
2013	1,439	60	-	1,354	201	10	20	71	**101**	156	-		**156**	**55**	47	46	44
2014	1,570	65	-	1,505	175	8	22	71	**101**	170	-		**170**	**69**	55	52	49
2015	1,711	71	-	1,662	176	8	25	78	**111**	186	-		**186**	**75**	55	51	47
2016	1,872	78	-	1,794	186	18	27	177	**222**	203	-		**203**	**(19)**	(13)	(12)	(11)
2017	2,044	85	-	1,653	539	51	24	156	**231**	222	-		**222**	**(9)**	(6)	(5)	(5)
2018	2,228	93	-	1,806	518	49	27	170	**246**	242	-		**242**	**(4)**	(2)	(2)	(2)
2019	2,424	101	-	2,011	518	49	30	190	**268**	263	-		**263**	**(5)**	(3)	(2)	(2)
2020	2,607	109	-	2,203	518	49	33	208	**289**	283	-		**283**	**(6)**	(3)	(3)	(2)
2021	2,799	117	-	2,401	536	51	36	227	**313**	304	-		**304**	**(9)**	(4)	(3)	(3)
2022	3,002	125	-	2,702	536	67	40	336	**442**	326	-		**326**	**(116)**	(50)	(41)	(33)
2023	3,215	134	-	2,903	536	67	43	363	**473**	349	-		**349**	**(124)**	(49)	(40)	(32)
2024	3,440	143	-	1,066	2,621	329	16	134	**478**	373	-		**373**	**(105)**	(39)	(30)	(24)
2025	3,677	153	-	1,025	2,887	362	15	129	**506**	399	-		**399**	**(107)**	(36)	(28)	(22)
TOTAL	**34,364**	**1,432**	**-**	**25,574**	**10,998**	**1,133**	**373**	**2,383**	**3,889**	**3,618**	**-**		**3,618**				
														NPV	**(45)**	**(15)**	**7**
														BC Ratio	**0.978**	**0.992**	**1.004**

Table 3.5.6: TOGO: Evaluation WITH Interconnection Projects

BENIN																	
	ENERGY					COSTS				REVENUES/BENEFITS				NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales		TOTAL		Present Worth ($M)		
															8%	10%	12%
2011	1,340	56	-	1,055	824	112	16	82	**210**	167	-		**167**	**(43)**	(43)	(43)	(43)
2012	1,468	61	-	1,314	227	33	19	119	**171**	183	-		**183**	**11**	11	10	10
2013	1,563	65	-	1,745	201	29	26	134	**189**	195	-		**195**	**5**	5	4	4
2014	1,696	71	-	3,373	175	17	50	-	**66**	211	-		**211**	**145**	115	109	103
2015	1,834	76	-	3,373	176	17	50	-	**66**	228	-		**228**	**162**	119	111	103
2016	1,967	82	-	3,373	186	17	50	-	**67**	245	-		**245**	**178**	121	110	101
2017	2,104	88	-	3,373	539	51	50	-	**101**	262	-		**262**	**161**	102	91	82
2018	2,247	94	-	3,373	518	47	50	-	**97**	280	-		**280**	**183**	107	94	83
2019	2,395	100	-	3,373	518	47	50	-	**97**	298	-		**298**	**201**	109	94	81
2020	2,575	107	-	3,373	518	47	50	-	**97**	321	-		**321**	**224**	112	95	81
2021	2,765	115	-	3,373	536	49	50	-	**99**	344	-		**344**	**246**	114	95	79
2022	2,965	124	-	3,373	536	49	50	-	**99**	369	-		**369**	**271**	116	95	78
2023	3,176	132	-	3,373	536	49	50	-	**99**	396	-		**396**	**297**	118	95	76
2024	3,398	142	-	3,373	2,621	239	50	-	**289**	423	-		**423**	**134**	49	39	31
2025	3,632	151	-	3,373	2,887	264	50	-	**314**	452	-		**452**	**139**	47	37	28
TOTAL	**35,123**	**1,463**	**-**	**44,588**	**10,998**	**956**	**644**	**253**	**1,852**	**4,208**	**-**		4,208				
														NPV	**1,200**	**1,034**	**897**
														BC Ratio	**1.967**	**1.921**	**1.873**

Table 3.5.7: BENIN: Evaluation WITH Interconnection Projects

SENEGAL																
	ENERGY					COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
														8%	10%	12%
2011	2,670	111	-	604	2,299	407	9	94	**510**	451	-	**451**	**(59)**	(59)	(59)	(59)
2012	2,986	124	-	748	2,485	440	11	119	**569**	505	-	**505**	**(65)**	(60)	(59)	(58)
2013	3,115	130	-	1,035	2,332	412	15	152	**580**	526	-	**526**	**(53)**	(46)	(44)	(42)
2014	3,261	136	136	-	3,661	727	-	-	**727**	551	27	**578**	**(149)**	(118)	(112)	(106)
2015	3,683	153	-	805	3,520	896	12	55	**963**	622	-	**622**	**(341)**	(250)	(233)	(216)
2016	4,239	177	-	333	4,203	1,017	5	26	**1,048**	716	-	**716**	**(332)**	(226)	(206)	(188)
2017	4,456	186	-	978	3,814	877	14	75	**967**	753	-	**753**	**(214)**	(135)	(121)	(109)
2018	4,690	195	-	1,581	3,499	820	23	71	**915**	793	-	**793**	**(122)**	(71)	(63)	(55)
2019	4,941	206	-	1,843	3,499	820	27	85	**932**	835	-	**835**	**(97)**	(52)	(45)	(39)
2020	5,217	217	-	2,140	3,507	821	32	101	**954**	882	-	**882**	**(72)**	(36)	(31)	(26)
2021	5,527	230	-	2,448	3,520	824	36	116	**976**	934	-	**934**	**(41)**	(19)	(16)	(13)
2022	5,831	243	-	2,760	3,524	825	41	130	**996**	986	-	**986**	**(10)**	(4)	(4)	(3)
2023	6,153	256	-	3,098	3,524	825	46	147	**1,017**	1,040	-	**1,040**	**23**	9	7	6
2024	6,499	271	-	3,444	3,544	828	51	163	**1,042**	1,098	-	**1,098**	**56**	21	16	13
2025	6,862	286	-	3,112	4,245	1,017	46	147	**1,210**	1,160	-	**1,160**	**(51)**	(17)	(13)	(10)
TOTAL	**70,129**	**2,922**	**136**	**24,929**	**51,176**	**11,148**	**360**	**1,388**	**12,895**	**11,402**	**27.0**	**11,429**				
													NPV	**(1,064)**	**(981)**	**(906)**
													BC Ratio	**0.86**	**0.86**	**0.85**

Table 3.5.8: SENEGAL: Evaluation WITH Interconnection Projects

MALI																
	ENERGY					COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
														8%	10%	12%
2011	1,199	50	604	-	1,882	294	-	-	**294**	249	94	**343**	**49**	49	49	49
2012	1,301	54	748	-	2,133	338	-	-	**338**	270	119	**388**	**50**	47	46	45
2013	1,457	61	1,012	-	2,224	330	-	-	**330**	302	150	**453**	**122**	105	101	97
2014	2,212	92	-	136	1,624	228	2	36	**266**	459	-	**459**	**193**	153	145	138
2015	2,332	97	439	797	1,346	169	12	61	**242**	484	55	**539**	**297**	218	203	189
2016	3,026	126	-	1,545	1,346	169	23	121	**313**	628	-	**628**	**315**	214	196	179
2017	3,133	131	-	1,154	1,307	147	17	91	**255**	650	-	**650**	**395**	249	223	200
2018	3,297	137	-	928	1,708	181	14	42	**236**	684	-	**684**	**448**	261	230	202
2019	3,397	142	-	1,016	1,728	185	15	47	**246**	705	-	**705**	**458**	248	214	185
2020	3,554	148	-	1,171	1,728	185	17	55	**257**	737	-	**737**	**480**	240	204	173
2021	3,731	155	-	1,331	1,728	185	20	63	**267**	774	-	**774**	**507**	235	195	163
2022	3,912	163	-	1,449	1,780	190	21	68	**280**	811	-	**811**	**532**	228	186	153
2023	4,096	171	-	1,640	1,780	190	24	78	**292**	850	-	**850**	**558**	222	178	143
2024	4,285	179	-	1,831	1,780	190	27	87	**304**	889	-	**889**	**585**	215	169	134
2025	4,479	187	-	2,007	1,802	193	30	95	**318**	929	-	**929**	**611**	208	161	125
TOTAL	**45,411**	**1,892**	**2,803**	**15,005**	**25,895**	**2,879**	**222**	**843**	**3,944**	**9,170**	**324.1**	**9,494**				
													NPV	**2,891**	**2,499**	**2,175**
													BC Ratio	**2.10**	**2.05**	**2.00**

Table 3.5.9: MALI: Evaluation WITH Interconnection Projects

LIBERIA																
	ENERGY					COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
														8%	10%	12%
2011	53	2	-	-	55	13	-	-	**13**	12	-	**12**	**(1)**	(1)	(1)	(1)
2012	117	5	-	-	122	28	-	-	**28**	27	-	**27**	**(1)**	(1)	(1)	(1)
2013	181	8	-	-	189	43	-	-	**43**	42	-	**42**	**(1)**	(1)	(1)	(1)
2014	252	10	-	-	262	60	-	-	**60**	58	-	**58**	**(2)**	(1)	(1)	(1)
2015	293	12	113	-	107	11	-	-	**11**	68	11	**79**	**68**	50	47	43
2016	310	13	117	-	107	11	-	-	**11**	72	11	**83**	**73**	49	45	41
2017	328	14	107	-	106	10	-	-	**10**	76	10	**86**	**76**	48	43	38
2018	351	15	809	-	882	66	-	-	**66**	81	61	**142**	**76**	44	39	34
2019	369	15	790	-	882	66	-	-	**66**	85	59	**144**	**78**	42	36	32
2020	398	17	759	-	882	66	-	-	**66**	92	57	**149**	**83**	41	35	30
2021	422	18	736	-	882	66	-	-	**66**	97	55	**153**	**86**	40	33	28
2022	451	19	708	-	882	66	-	-	**66**	104	53	**157**	**91**	39	32	26
2023	480	20	1,400	-	1,613	101	-	-	**101**	111	88	**199**	**97**	39	31	25
2024	509	21	1,866	-	2,124	125	-	-	**125**	118	110	**227**	**102**	38	30	23
2025	544	23	1,862	-	2,157	126	-	-	**126**	126	109	**235**	**108**	37	29	22
TOTAL	**5,059**	**211**	**9,267**	**-**	**11,252**	**846**	**-**	**-**	**846**	**1,155**	**625.2**	**1,780**				
													NPV	**463**	**395**	**339**
													BC Ratio	**2.05**	**2.03**	**2.02**

Table 3.5.10: LIBERIA: Evaluation WITH Interconnection Projects

SIERRA LEONE																
	ENERGY					COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
														8%	10%	12%
2011	222	9	-	-	232	12	-	-	**12**	51	-	**51**	**40**	40	40	40
2012	293	12	-	-	305	13	-	-	**13**	68	-	**68**	**54**	50	49	48
2013	398	17	-	-	415	15	-	-	**15**	92	-	**92**	**77**	66	64	62
2014	533	22	-	-	555	15	-	-	**15**	123	-	**123**	**108**	86	81	77
2015	644	27	-	351	466	23	5	18	**47**	149	-	**149**	**102**	75	70	65
2016	785	33	-	352	466	23	5	30	**58**	181	-	**181**	**123**	84	76	70
2017	867	36	436	-	1,361	61	-	-	**61**	200	20	**219**	**158**	100	89	80
2018	907	38	844	-	1,865	83	-	-	**83**	209	37	**247**	**164**	96	84	74
2019	948	40	843	-	1,865	83	-	-	**83**	219	37	**256**	**174**	94	81	70
2020	995	41	796	-	1,865	83	-	-	**83**	230	35	**265**	**182**	91	77	66
2021	1,048	44	744	-	1,865	83	-	-	**83**	242	33	**275**	**192**	89	74	62
2022	1,101	46	690	-	1,865	83	-	-	**83**	254	31	**284**	**202**	87	71	58
2023	1,159	48	630	-	1,865	83	-	-	**83**	267	28	**295**	**213**	84	68	55
2024	1,212	50	583	-	1,872	83	-	-	**83**	280	26	**305**	**223**	82	65	51
2025	1,270	53	525	-	1,872	83	-	-	**83**	293	23	**316**	**234**	80	62	48
TOTAL	**12,383**	**516**	**6,091**	**703**	**18,732**	**811**	**10**	**48**	**869**	**2,805**	**270**	**3,075**				
													NPV	**1,202**	**1,050**	**925**
													BC Ratio	**3.62**	**3.64**	**3.66**

Table 3.5.11: SIERRA LEONE: Evaluation WITH Interconnection Projects

GUINEA																
	ENERGY					COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
														8%	10%	12%
2011	814	34	-	-	848	71	-	-	**71**	68	-	**68**	**(3)**	(3)	(3)	(3)
2012	960	40	-	-	1,000	102	-	-	**102**	81	-	**81**	**(21)**	(19)	(19)	(19)
2013	1,112	46	-	-	1,159	132	-	-	**132**	94	-	**94**	**(39)**	(33)	(32)	(31)
2014	1,294	54	-	-	1,348	163	-	-	**163**	109	-	**109**	**(54)**	(43)	(41)	(38)
2015	1,569	65	-	1,362	953	98	20	56	**175**	132	-	**132**	**(43)**	(31)	(29)	(27)
2016	1,769	74	-	1,400	493	30	21	112	**163**	149	-	**149**	**(15)**	(10)	(9)	(8)
2017	1,820	76	174	-	1,709	95	-	-	**95**	153	10	**163**	**68**	43	38	34
2018	1,877	78	4,099	-	5,872	265	-	-	**265**	158	185	**343**	**78**	45	40	35
2019	1,934	81	5,916	-	7,824	360	-	-	**360**	163	272	**435**	**75**	41	35	30
2020	1,991	83	7,625	-	9,667	454	-	-	**454**	168	358	**526**	**72**	36	30	26
2021	2,089	87	7,650	-	9,781	462	-	-	**462**	176	361	**537**	**75**	35	29	24
2022	2,158	90	7,594	-	9,782	462	-	-	**462**	182	359	**540**	**78**	34	27	22
2023	2,232	93	7,512	-	9,793	464	-	-	**464**	188	356	**543**	**80**	32	25	20
2024	2,301	96	7,455	-	9,797	464	-	-	**464**	194	353	**547**	**83**	30	24	19
2025	2,370	99	7,390	-	9,797	464	-	-	**464**	199	350	**550**	**85**	29	22	17
TOTAL	**26,290**	**1,095**	**55,415**	**2,762**	**79,821**	**4,015**	**41**	**169**	**4,225**	**2,143**	**2,604**	**4,747**				
													NPV	**185**	**140**	**103**
													BC Ratio	**1.08**	**1.07**	**1.06**

Table 3.5.12: GUINEA: Evaluation WITH Interconnection Projects

GUINEA BISSAU																
	ENERGY					COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
														8%	10%	12%
2011	172	7	-	-	179	41	-	-	**41**	28	-	**28**	**(13)**	(13)	(13)	(13)
2012	188	8	-	-	196	45	-	-	**45**	31	-	**31**	**(14)**	(13)	(13)	(13)
2013	199	8	-	-	207	48	-	-	**48**	33	-	**33**	**(15)**	(13)	(13)	(12)
2014	210	9	-	-	219	51	-	-	**51**	34	-	**34**	**(16)**	(13)	(12)	(11)
2015	223	9	-	-	232	53	-	-	**53**	36	-	**36**	**(17)**	(12)	(11)	(11)
2016	236	10	-	-	245	57	-	-	**57**	39	-	**39**	**(18)**	(12)	(11)	(10)
2017	293	12	-	294	23	5	4	23	**33**	48	-	**48**	**16**	10	9	8
2018	354	15	-	396	0	0	6	18	**24**	58	-	**58**	**34**	20	18	16
2019	418	17	-	475	0	0	7	22	**29**	69	-	**69**	**40**	21	19	16
2020	486	20	-	548	0	0	8	26	**34**	80	-	**80**	**46**	23	19	17
2021	556	23	-	623	6	1	9	29	**40**	91	-	**91**	**51**	24	20	16
2022	587	24	-	654	6	1	10	31	**42**	96	-	**96**	**54**	23	19	16
2023	619	26	-	690	6	1	10	33	**44**	101	-	**101**	**57**	23	18	15
2024	652	27	-	733	7	2	11	35	**47**	107	-	**107**	**60**	22	17	14
2025	687	29	-	766	7	2	11	36	**49**	113	-	**113**	**63**	22	17	13
TOTAL	**5,878**	**245**	**-**	**5,179**	**1,334**	**266**	**77**	**252**	**595**	**936**	**-**	**936**				
													NPV	**111**	**82**	**59**
													BC Ratio	**1.28**	**1.23**	**1.18**

Table 3.5.13: GUINEA BISSAU: Evaluation WITH Interconnection Projects

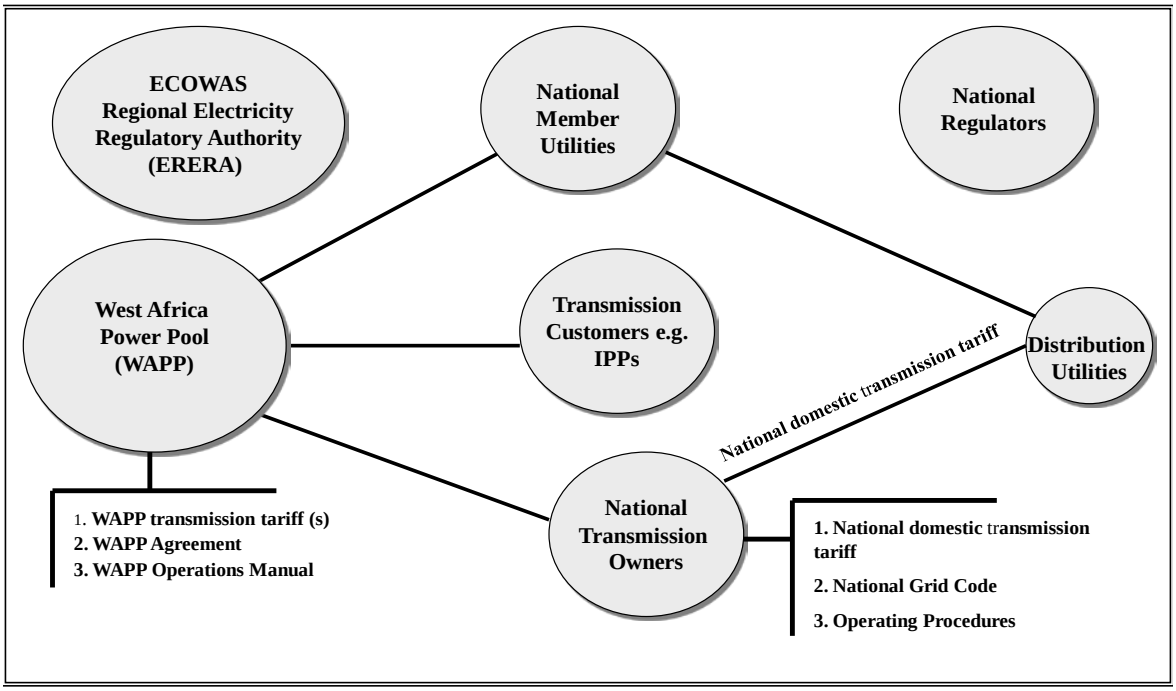
GAMBIA																
	ENERGY					COSTS				REVENUES/BENEFITS			NET BENEFITS			
	SALES	LOSSES	EXPORTS	IMPORTS	Internal Generation	Intern Gen Cost	TSC	Cost of Imports	TOTAL	Domestic Sales	Exports Sales	TOTAL		Present Worth ($M)		
														8%	10%	12%
2011	293	12	-	-	305	70	-	-	**70**	48	-	**48**	**(22)**	(22)	(22)	(22)
2012	357	15	-	-	372	86	-	-	**86**	59	-	**59**	**(27)**	(25)	(25)	(24)
2013	410	17	-	-	427	97	-	-	**97**	67	-	**67**	**(30)**	(26)	(25)	(24)
2014	463	19	-	-	482	110	-	-	**110**	76	-	**76**	**(34)**	(27)	(26)	(24)
2015	550	23	-	-	573	114	-	-	**114**	90	-	**90**	**(24)**	(18)	(16)	(15)
2016	697	29	-	-	726	149	-	-	**149**	114	-	**114**	**(35)**	(24)	(22)	(20)
2017	720	30	-	596	155	18	9	33	**59**	118	-	**118**	**59**	37	33	30
2018	744	31	-	739	36	5	11	33	**50**	122	-	**122**	**72**	42	37	33
2019	767	32	-	763	36	5	11	35	**52**	126	-	**126**	**74**	40	35	30
2020	790	33	-	793	37	5	12	37	**54**	130	-	**130**	**75**	38	32	27
2021	826	34	-	824	41	6	12	39	**57**	135	-	**135**	**78**	36	30	25
2022	855	36	-	837	57	8	12	40	**60**	140	-	**140**	**80**	34	28	23
2023	884	37	-	862	64	9	13	41	**63**	145	-	**145**	**82**	33	26	21
2024	919	38	-	900	65	9	13	43	**65**	151	-	**151**	**85**	31	25	20
2025	954	40	-	874	125	15	13	41	**70**	157	-	**157**	**87**	30	23	18
TOTAL	**10,228**	**426**	**-**	**7,188**	**3,501**	**639**	**106**	**342**	**1,087**	**1,629**	**-**	**1,629**				
													NPV	**179**	**133**	**96**
													BC Ratio	**1.24**	**1.19**	**1.15**

Table 3.5.14: GAMBIA: Evaluation WITH Interconnection Projects

CHAPTER 4: WAPP PROJECT IMPLEMENTATION STRATEGY

APPENDIX 1: WAPP DOCUMENT FRAMEWORK

ILLUSTRATION OF POSSIBLE
West Africa Power Pool Document Framework



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