PROJECT: NIGERIA-NIGER-BENIN/TOGO-BURKINA FASO ELECTRIC POWER INTERCONNECTION PROJECT

COUNTRY: MULTINATIONAL- NIGERIA-NIGER-BENIN/TOGO-BURKINA FASO

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT SUMMARY (ESIA)

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1. INTRODUCTION

This document is the summary of the Environmental and Social Impact Assessment (ESIA) of the Nigeria-Niger-Benin/Togo-Burkina Faso Interconnection Project. This summary was prepared in accordance with the AfDB’s environmental and social assessment procedures for Category 1 projects. It was prepared on the basis of the ESIA reports carried out in each of the countries concerned by the line’s route. It briefly recalls the project’s strategic, legal and administrative framework, its description and environment, other alternative solutions explored in relation to the option retained, the project’s environmental and social impacts as well as the recommended mitigation and enhancement measures, the concerns raised during public consultations in addition to a summary of the impact mitigation and enhancement measures as defined in the management plans and the implementation monitoring mechanisms.

2. POLICY, LEGAL, ADMINISTRATIVE AND INSTITUTIONAL FRAMEWORK

2.1 Legal Framework

Benin


In addition to these legal instruments, the most important regulatory instruments are: Decree 2001-235 of 12 July 2001 on the organization of the environmental impact assessment process; Decree 2001-110 of April 2001 on air quality standards in the Republic of Benin; Decree No. 2001-294 of 8 August 2001 on the regulation of noise in the Republic of Benin and Decree 2001-109 of 4 April 2001 on waste water quality standards.


In Burkina Faso

determining conditions for the set-up and operation of dangerous, unhealthy and inconvenient establishments; (v) Decree 2001-185/PRES/PM/MEE of 7 May 2001, determining standards for the discharge of pollutants in the air and water and on the ground; and (vi) Decree 2001-342/PRES/PM/MEE of 17 July 2001 defining the scope, content and procedure of the EIA and EIN.

In Niger

In Niger, Article 35 of the Constitution of 28 November 2010 governs sustainable environmental and management in Niger. It confers the right to any person to a healthy environment and the duty to protect it. The main legal instruments governing environmental and social management are: (i) Order 93 - 015 of 2 March 1993 setting Guidelines for the Rural Code (POCR); (ii) Order 97-001 of 10 January 1997 institutionalizing Environmental Impact Studies (EIS); (iii) Law No. 98-56 of 29 December 1998 laying down the framework Law on Environmental Management; (iv) Law No. 98-07 of 29 April 1998 governing hunting and wildlife protection; (v) Decree 2000-397/PRN/MH/E/LCD of 20 October 2000 concerning the administrative procedure for environmental impact assessments and reviews; (vi) Decree 2010–540/PCS/ME/LCD of 8 July 2010 laying down the organization and operation of BEEEI and defining the responsibilities of its Director; and (vii) Decree 2000-398/PRN/ME/LCD of 20 October 2000 defining the list of activities, works and planning documents subject to EIA.

In Nigeria

The requirements of Nigerian legislation in force mainly concern: (i) Environmental Impact Assessment (EIA) Act No. 86 of 1992, which restricts public or private development projects without prior consideration of the environmental impact; (ii) National Environmental Standards and Regulations Enforcement Agency Law of 2007, which empowers the Agency to enforce all national environmental laws and regulations (except those related to the oil and gas sector) and international treaties or conventions to which Nigeria is signatory. The Agency has issued 24 environmental regulations which prescribe pollution abatement measures, limits and other safeguards for various industries and for noise, surface and ground water discharges among others. These mainly concern: (i) national environmental regulations concerning the protection of wetlands, river banks and lake shores (2009) and ii) National Environmental (Protection of Watershed, Mountainous, Hilly and Catchment Areas) Regulations, 2009 with a direct impact on the proposed project; (iii) National Electric Power Sector Reform Act (2005), which established the National Electricity Power Authority (NEPA) and requires all entities intending to generate, transmit and or distribute power to include an EIA Approval Certificate, or Proof of submission and acceptance for processing of the EIA report to the Ministry of Environment in their applications; (iv) National Policy on the Environment, with the goal of achieving sustainable development for the country and emphasis on (a) securing for all Nigerians a quality environment adequate for their health and well-being; (b) conserving and using the environment and natural resources for the benefit of present and future generations; and (c) restoring, maintaining and enhancing ecosystems and ecological processes essential for the functioning of the biosphere and for the preservation of biological diversity and to adopt the principle of optimum sustainable yield in the use of natural resources and ecosystems; and (v) the Land Use Act (1978), which recognizes the rights of all Nigerians to use and enjoy land and the natural fruits thereof in sufficient quality to enable them to provide for the sustenance of themselves and their families.

2.2 Administrative and Institutional Framework

Benin

New Ministries were established pursuant to Decree 2013-319 of 11 August 2013 to manage all matters pertaining to the energy sector in Benin including the Ministry of Energy, Petroleum and Mining Research and Renewable Energy Development (MERPMDER).
Before 2013, environment and nature-related issues fell within the remit of the Ministry of Environment, Housing and Urban Planning (MEHU). In 2013, in order to achieve its objective of attaching the utmost importance to the environment, the Government of Benin established two new ministries, the first responsible for the environment and protection of natural and forest resources, and the second for a healthier and better living environment pursuant to Decree 2013-319 of 11 August 2013 concerning the composition of the Government: (i) Ministry of Environment, responsible for Climate Change, Reforestation and Natural and Forestry Resource Protection (MECGCCPRNF); (ii) Ministry of Urban Planning, Housing and Sanitation (MUHA). The aim of these two Ministries is to propose national development policies and strategies, especially in the environment and natural resource protection and living environment sectors and see to their implementation.

Pursuant to Articles 12 of the Framework Law on the Environment and 1 and 2 of Decree 2010-478 of 15 November 2010, the Benin Environmental Agency (ABE) is a an authority of a social, cultural and scientific nature with moral personality and financial autonomy which, pursuant to Decree 2013-319 of August 2013, is now under the oversight of MECGCCPRNF. It is the body responsible for implementing the environmental policy defined by the Government as part of its general development plan.

**In Burkina Faso**

At the institutional level, several actors play a role in the design, coordination, application and control of central government actions in the areas of environmental safety, protection and conservation:

(i) Ministry responsible for Energy with the National Electricity Company of Burkina Faso and its Standardization, Environment and Safety Department (DNES);

(ii) Ministry of Environment, Green Economy and Climate Change (MEEVCC);

(iii) Ministry of Territorial Administration and Decentralization. This is the oversight Ministry for decentralization bodies and development issues (Governorates of the regions, High Commissioners and Prefects, municipal authorities). It is responsible for ensuring the implementation and monitoring of the Government’s decentralization policy.

(iv) National Environmental Assessment Agency (BUNEE). It is attached to the MEEVCC and its purpose is to promote, supervise and manage the country’s entire environmental assessment process. It is mandated to coordinate the implementation, monitoring and promotion of environmental assessment and inspection policy. The validation process for this report and the delivery of the reasoned opinion fall within its remit.

**In Niger**

The institutional actors concerned by the project are to be found in the central administration, parastatal and private sector organizations as well as in the localities where the project will be implemented. The main actors are: the Ministry of Environment, Urban Hygiene and Sustainable Development (MESU/DD), the Environmental Assessment Impact Studies Agency (BEEEI), Ministry of Energy and Oil, Ministry of Water Supply and Sanitation, Ministry of Agriculture and Livestock, Ministry of Public Health, Ministry of Mines and Industrial Development, Ministry of Employment, Labour and Social Security, Ministry of Interior, Public Safety, Decentralization and Customary and Religious Affairs, Territorial Communities, the National Environmental Council for Sustainable Development (CNEDD), the ‘NIGELEC’ electricity company, the Council of Energy of Niger (a non-profit organization); the traditional chiefdom, Civil Society, Organizations, in particular, the Grouping of Organizations defending the Right to Energy and the Nigerien Association of Environmental Impact Assessment Professionals (ANPÉIE).
In Nigeria

At the institutional level, the main institutions concerned are:

(i) The Federal Ministry of Environment is responsible for the country’s overall environmental policy. It is responsible for ESIA implementation and approval. It has prepared guidelines and regulations for protecting the environment and promoting sustainable development;

(ii) Transmission Company of Nigeria (TCN). It is responsible for works supervision and its Health Safety and Environment Unit will be responsible for monitoring that component;

(iii) Kebbi State Ministry of Environment is responsible for overall environmental policy in Kebbi State, enforcement of the State’s environmental laws as well as the establishment of regulations, sanitation and waste management; and

(iv) The National Environmental Standards and Regulations Enforcement Agency (NESREA) which falls under the authority of the Ministry of Environment. It replaces the Federal Environmental Protection Agency.

For all the countries concerned, this project is subject to the completion of a full ESIA.

2.3 International Agreements

The countries concerned by the project are signatories to most of the international and regional agreements on environmental protections, the most important of which are: (i) the UNESCO Paris Agreement concerning the Protection of the World Cultural and Natural Heritage; (ii) the CITES Convention, the United Nations Rio Convention on Biological Diversity (CBD); (iii) United Nations Framework Convention on Climate Change (UNFCCC); (iv) Rotterdam Convention on PIC and the Stockholm Convention on POPs (v) Geneva Tropical Timber Agreement; (vi) Maputo African Convention on the Conservation of Nature and Natural Resources to ensure the sustainable development of African economies.

2.4 For the African Development Bank (AfDB)

The Integrated Safeguards System (ISS) through five operational safeguards (OS):

- Operational Safeguard 1: Environmental and Social Assessment;
- Operational Safeguard 2: Involuntary Resettlement, Land Acquisition, Population Displacement and Compensation;
- Operational Safeguard 3: Biodiversity and Ecosystem Services;
- Operational Safeguard 4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials and Efficient Resource Use; and

All five safeguards have been triggered.

Other relevant policies and guidelines remain applicable once triggered under the ISS. The main ones include (but are not exhaustive):

- the Bank’s Gender Policy (2001);
- the Framework for Enhanced Engagement with Civil Society Organizations (2012);
• the Disclosure and Access to Information Policy (2012);
• the Handbook on Stakeholder Consultation and Participation in Bank Operations (2001);
• the Bank Policy on Population and Implementation Strategy (2002); and

3. PROJECT RATIONALE AND DESCRIPTION

3.1 Rationale

The project provides a medium–term response to the main problems experienced by the low energy producing countries of Niger, Burkina Faso and Benin reflected in the population’s low access rate (Benin: 18 %, Burkina Faso: 19 % and Niger: 11%), the dominance of excessively expensive thermally generated electricity, thereby making their respective electricity sub-sectors loss-making due to the inadequacy of the rates applied. In the case of Nigeria, the project will enable it to increase its export earnings and intensify electrification along its border with Niger. In the long-term, the transport infrastructure created by the project will constitute a major link in the establishment of the sub-regional electric power market to which countries currently considered to be only importers will contribute as suppliers (1000 MW solar power programme in Burkina; 125MW Kandadji hydro-power plant and 200 MW coal-fired plant at Salkadamma expandable to 600 MW in Niger; and the 147 MW hydro-power plant in Adjarala in Benin.

The project is one of the priorities of the ECOWAS Electric Power Generation and Transmission Master Plan approved in February 2012. It is also consistent with the third strategic thrust of Burkina Faso’s National Economic and Social Development Plan covering the 2016-2020 period (2016-2020 PNDES) aimed at revitalizing high potential sectors for the economy and jobs; and with the fourth strategic thrust of Niger’s Economic and Social Development Plan for the 2012–2015 period extended to end-2017 (2012-2015 PNDES) the objective of which is to promote a competitive and diversified economy with a view to achieving accelerated and inclusive growth. In Benin, the project is in keeping with the actions planned in the Government’s Energy Sector Action Plan (2015-2020) which aims to have adequate power supply from 2019 to meet the needs of the economy and households. In Nigeria, the project is in line with the third thrust of the new economic policy aimed at boosting the economy through an increase in capital expenditure on infrastructure.

3.2 Project Objectives and Components

The project aims to promote electric energy exchanges in the WAPP region, increase the electricity access rates of the populations of Niger, Burkina Faso, Benin and Togo through access to the predominantly gas and hydropower energy resources of Nigeria. It will help to reduce the costly investments of these three countries in thermally generated energy, mainly based on fossil fuels. The project will help to reduce greenhouse gas emissions. This integrating project will also contribute to an improvement in the living conditions of the populations in its area of influence (lighting for basic social services, health centre, schools and administrative services) and the creation of income-generating activities in rural areas.
Table 1: Project Components

The main components of the Electric Power Interconnection Project are:

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<th>Components</th>
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| Transmission Infrastructure       | - Extension of the Birnin Kebbi (Nigeria) 330 kV sub-station  
- Construction of a 330 kV transmission line between Birnin Kebbi (Nigeria) and Niamey (Niger)  
- Extension of 330/132/66 kV sub-station in Niamey  
- Construction of a 330/132 kV sub-station in Zabori (Niger)  
- Construction of a 330 kV line between Zabori (Niger) and Malanville (Benin)  
- Construction of a 330 kV line between Niamey and Ouagadougou  
- Construction of a 330/225 kV sub-station in Ouagadougou  
- Extension of the South-East Ouagadougou sub-station |
| Rural Electrification             | Electrification of communities within a 5 km radius of each side of the transmission line in the four countries                                                                                         |
| Institutional Support and Project Management | - Operation of the Project Management Unit (PMU)  
- Institutional support to the WAPP General Secretariat  
- Works Control and Supervision, Project Audit  
- Assistance to Project Owner  
- Capacity Building |
| Impact Mitigation                 | Management of environmental and social impacts, relocation of populations and compensation of affected people                                                                                           |

The total project cost is UA 547.34 million to be financed by the African Development Bank Group to the tune of UA 97.07 million and the World Bank (WB), Islamic Development Bank (IsDB), French Development Agency (AFD), German Cooperation (KFW), ECOWAS Investment and Development Bank (EIDB) and Chinese cooperation to the tune of UA 312.20 million. The countries concerned will contribute UA 19.5 million.

The main project outcomes concern the supply of electricity to the productive sectors of the economies of the countries concerned; reduction in the cost price per kWh in Niger, Burkina, and in Benin/Togo; facilitation of access to electricity; expansion of the power pool system and creation of a regional electric power market. Power transit forecasts on project completion in 2020 are 300 MW, which will rise to 666 MW in 2025 and 915 MW in 2035. The rural electrification component will concern a population of 540,000 people spread over 294 rural communities and 68,000 households in Nigeria, Niger, Benin/Togo and Burkina Faso.
3.3 **Description of the Line’s Route**

**Benin**

In Benin, the power line covers a distance of 12 km. It crosses the Niger River and bypasses the periurban area of Malanville to the west. The line also bypasses the hilly area to the South-West of Malanville. According to available information, between 30 and 35 pylons – including 9 angled pylons – are planned with a span of 450 metres. A 50 metre-wide right-of-way was pre-selected for the purpose of studying routes and selecting the best option. It is expected that this 50 m. right-of-way will be adequate to fulfil the technical requirements that the 330 kV transmission lines will have to meet. The new Malanville sub-station will be constructed. It will be located 3km south of Badjekali (11.782 ° N 3.374 ° E) and accessible by a tertiary road connecting with National Road E2. The sub-station covers an area of about 70,000 m².

**Burkina Faso**

In Burkina Faso, the project consists of a 330 kV line from the Niger border to the East-Ouaga sub-station in Ouagadougou. The line has the following characteristics: (i) covers a distance of 381km with a 50 m right-of-way (ii) follows the south-west side of the NR4 for 5 km and crosses the NR 19 at the level of Kantchari; (iii) Curves in towards the west and continues to follow the NR 4 on the south side; (iv) Crosses the NR 4 at the level of Nalougou and continues to follow that road, on the north side thus avoiding the agro-pastoral and pastoral areas of Tapoa-Boopo; (v) leaves the edges of the NR4 on the approach to the town limits of Fada N’gouma and bypasses the town to the north and, on the other side, once again crosses the NR4; (vi) continues south of NR4 westwards to Koupela which it bypasses to the south crossing the NR 16; (vii) then curves in slightly to the north-west continuing to follow the south side of NR4 thus passing to the north of the Silmiougou pastoral area, a military base and the site of the Boromé gold mine; (viii) runs along the NR 4 which then crosses the Volta Valley irrigation schemes for about 22km having passed the town of Rapadama and crosses the N4 twice, once near the Kougré community and once on leaving the Volta Valley irrigation schemes; (ix) where it crosses the N4 at the level of Kougré, the line passes close to the southern limits of the Wayen national park; (x) continues to follow the NR4 while curving in slightly towards the south-west, slightly encroaching on the northern limits of Gonse national park for about 3 km to finally reach the Ouaga-East sub-station from the north.
Niger

Three sections of the new 330 kV line cross Niger, once between the border with Nigeria and the future Gorou Banda sub-station in Niamey, then between that sub-station and the border with Burkina Faso and, finally, between the future Zabori sub-station and the border with Benin.

The first section from the border with Nigeria to the future Gorou Banda sub-station has the following characteristics: (i) covers a distance of 208 km with a 50m right-of-way; (ii) from the border with Nigeria to the environs of the future Zabori sub-station: crosses the Maouri Dallo Ramsar site for 24 km; (iii) to the east of Dosso: crosses the Bosso Dallo Ramsar Site for 37km parallel to the NR 1 and the existing 132kV power line; (iv) crosses the Niger River flood plain close to Tahirou Koir; and (v) reaches the future Gorou Banda sub-station to the South of Niamey.

The second section from the future Gorou Banda sub-station to the Burkina Faso border has the following characteristics: (i) covers a distance of 104 km, with a 50km right-of-way; (ii) leaves the Gorou Banda sub-station in a south-westerly direction; (iii) connects with the NR6 and follows it to the border with Burkina Faso; and (iv) crosses the Makalondi District biodiversity and bird sanctuary area for about 50km.

The third section from the future site of the Zabori sub-station to the Niger/Benin border has the following characteristics: (i) covers a length of 108 km with a 50 metre right-of-way; (ii) leaves the future Zabori sub-station towards the south-west; (iii) runs along a short section of the north-west limits of the Maouri Dallo Ramsar site; (iv) branches to the south until it joins the NR 7 at the level of Gonga Innza and continues to run parallel to the west side of that road for about 10km; (v) leaves the NR7 and continues across a classified forest area; (vi) passes less than 2 km west of the limits of the Gourou-Bassounga National Park and reaches the Niger River flood plain as well as the border with Benin.

Nigeria

The 330 kV line links the Bernin Kebbi sub-station to the border with Niger and has the following characteristics:

- Covers 62 km with a 50-m right-of-way;
- Leaves north of the Bernin Kebbi sub-station running along the corridor of the 330 KV Kanji-Bernin Kebbi line, bypasses the town and joins the corridor of the existing 132 kV line;
- Crosses the Sokoto River flood plain for 8 km running along the existing 132 kV power line; and
- Continues to run along 48 km of the existing 132 kV power line towards the Niger border.

4. DESCRIPTION OF THE PROJECT’S ENVIRONMENT

Direct Impact Area:

The receiving environment is characterized by several environmental and social components. In order to clearly identify the characteristics of each of them, the study areas which were used to characterize them, vary in size. However, at a minimum, the study area was to cover a 500-metre corridor, 250 metres on either side of the power line’s route and also a 250-metre area around the areas identified for the construction of electricity sub-stations. This area is considered to be the project’s direct area of influence and was subjected to more intensive characterization.
A 50 metre-wide right-of-way was pre-selected in the four countries for the purpose of the route studies and the selection of the preferred option. This 50-metre right-of-way is expected to be sufficient to meet the technical requirements that the 330 kV transmission lines must comply with: (i) noise level and radio interference; (ii) electric and magnetic fields; (iii) minimum clearance taking into account conductor swing in conditions of high winds; (iv) safety clearance in the scenario of a pylon collapse.

In the case of the 225kV line in Burkina Faso the basic right-of-way between the East-Ouaga sub-station and the terminal pylon (TP5) is 50 metres. However a width of 25 metres has been earmarked between the East-Ouaga and South-East Ouaga sub-stations resulting in a 75-metre right-of-way. The planned right-of-way for the 90kV line between the East-Ouaga and Kossodo lines will be 50 metres. This right-of-way will be adapted to the existing roads on the approach to the industrial zone of Kossodo near the Kossodo sub-station.

**Indirect Area of Influence**

On the basis of the route options generated, the mapping of the environmental and social components was carried out within a 10-kilometre corridor. This mapping was carried out by photographic interpretation of satellite images in which, in particular, villages, military bases, national roads, power transmission lines, airports, major water courses, flood-prone areas, sloping areas, plantations, pastoral areas, protected areas, key areas for bird protection, key biodiversity areas, Volta Valley irrigation schemes and RAMSAR sites were identified. The route options were then optimized in order to avoid as many obstacles as possible and take advantage of route opportunities in places with greater impact. The angle points were also assessed and displaced by the algorithm used to assess the economic costs of the route options.

**4.1 Physical Environment**

**4.1.1 Climate**

**Benin**

The climate of the study area Sudano-Sahelian in nature with a rainy season from May to October and a dry season from November to April. The dominant wind is the Harmattan which blows from November to January. The study area contains a vast plain prone to flooding due to run-off from the river and one of its tributaries (Sota River) in the rainy season. After crossing the plain, it runs along a hill not far from Bodjécali village.

Air quality in Malanville municipality is regularly affected by natural changes caused by the Harmattan which blows during the dry season stirring up considerable sand and dust.

In terms of climate risk, the study area comprises a plane prone to flooding due to run-off from the river and one of its tributaries (the Sota River) in the rainy season. After crossing the plain, it runs along a hill not far from Bodjécali village. This flood-prone area which is also sensitive to erosion represents less than 10% of the study area.

**Burkina Faso**

The Sudano-Sahelian region where the study area is located is characterized by rainfall which begins in early April and declines in late October. On average, the localized weather stations in the study area receive 743.8 mm of rain. The months of July and August have the highest rainfall. The lowest temperatures are observed in December-January (16 to 17°C) with a slight drop in August-September (22 to 32°C), while maximum temperatures are reached in March-April (39.7 to 40.0°C) and in November (36.6°C).
As regards air quality, the main climatic or natural factors influencing the value of dust emissions are the Harmattan at all the collection points. Human factors also contribute and are mainly the result of traffic of vehicles and two-wheeled vehicles on unasphalted roads (road traffic), the use of fuel as well as livestock.

**Niger**

Niger’s climate is continental-sahelian in nature characterized by two seasons: (i) a short rainy season (June to September), and (ii) a long dry season (October to May). Annual rainfall is characterized by significant spatial, temporal and inter-annual variability.

In terms of climate risk, the line crosses the Niger River floodplain near Tahirou Koira. It also passes less than 2 km to the west of the Gourou-Bassounga national park limits and reaches the Niger River floodplain which it crosses.

**Nigeria**

The study area has a continental tropical climate characterized by a rainy season between June and September in the north and April to October with a peak in July (366 mm) in other parts. The Sahelian air which accompanies the dry season in the regions is characterized by low relative humidity and intense dryness which creates a dusty atmosphere. Average relative humidity is between 12.9 and 62.5% with a minimum average air temperature of 21.2°C – 23.9°C and average maximum temperatures of 29.3 – 39.3°C.

In terms of climate risk, the line crosses the 8 km of the Sokoto River floodplain running along the existing 132 kV power line.

**4.1.2 Soil, Topography and Relief**

**Benin**

The area’s soils have, in general, not evolved much. The dominant soils are: highly weathered ferralsols on a crystalline base but less pronounced than in the case of ferralitic soil and by an accumulation of ferric hydrate associated with very few aluminum oxides; very fertile alluvial soils (sandy and clayey) of the Niger Valley, whose high fertility potential is suitable for a large number of annual crops; clayey black silty soils in very fertile bottomlands, marshes and gallery forests where rice farming and market gardening are carried out and yams grown.

**Burkina Faso**

In terms of topography, the highest elevations are to be found in the section which is closest to the border with Niger where the altitude reaches 410 metres. The lowest elevations are in the bottomlands not far from Fada N’gourma with an altitude of 249 metres. The relief is, therefore, constant with a few hills and bottomlands marking the territory. There are 6 classes of soil in the study area: crude mineral soils, cambisols, vertisols, brown soil, iron and manganese sesquioxide rich soils and hydromorphous soils.

**Niger**

In the project area, there are five categories of soil distributed according to the different types of relief: raw mineral soils from erosion, cambisols from erosion, tropical feral soils, ferralitic soils on sandy clay and hydromorphous soils. Soil samples were taken to analyse their quality. It was shown that these soils were not contaminated but have traces of heavy metals and are slightly acidic (with pH of between 4.9 and 6).
Nigeria

The northern part of the project area is characterized by low altitude plains dissected by former stabilized dunes from wind deposits, flat-topped remains of more ancient landscapes with iron sheets or rocks and low drops. In the project area, the soils correspond to three main units: (i) S1: very deep, well drained, yellow reddish to chestnut brown, clayey soils and clayey sandy soil on gentle slope associated with the topography of elevated land; (ii) S2: very deep, very poorly drained, pale brown to greyish brown clayey soils and silty sandy soils on floodplains; (iii) S3: very deep, well drained, yellowish to dark brown, sandy loam and sandy silt on clayey sandy soils on hills degraded by gravel and laterite deposits.

4.1.3 Hydrography and Water Resources

Benin

In terms of groundwater, the study area is connected to the Beninese part of the Iullemeden aquifer system, of which it forms an outlet to the Niger River. The following four aquifers are in the project area: the continental intercalary /hamidian aquifer, the aquifer of lower continental terminal sands and the unconfined continental terminal and alluvial deposits. The findings of the water analyses show that the physico-chemical quality of the groundwater sampled is acceptable.

Burkina Faso

The study area crosses two international watersheds, i.e. those of the Niger and Volta Rivers as well as the Nakanbé national catchment basin. In general the underground waters of the study area are contained in two main aquifer systems, those of the crystalline base which cover most of the country (over 80% of the territory) and those of the sedimentary area to be found on low surface areas. Water in them is usually safe and greatly used by the communities.

Niger

The study area is in a region with highly variable rainfall: low in the north and fairly abundant in the south in relation to the rest of the country. While seriously degraded from a morphological standpoint, the hydrographic network is fairly active. Overall surface water resources are significant (over 30 billion m³ in a normal year). The study area crosses four sub-watersheds: (i) the Maouri Dallol sub-watershed (in Gaya and Dosso Departments); (ii) the Bosso Dallol sub-watershed (in Dosso and Boboye Departments); (iii) the Niger River Valley sub-watershed (in Kollo Department and Niamey region); (iv) the Goroubi sub-region (in Say Department). From a hydrographic standpoint, the country only has one permanent water course, the River Niger which crosses about 550 km in the western part of the country. It is worth mentioning that from 12 to 18 June 1985, an almost zero flow rate was observed in the Niger River and for a few minutes in June 2004. The study area is in the Nigerien part of the Niger basin which comprises the following two (2) hydrological units: (i) the Niger River: a permanent water course crossing 550 km of the country and its tributaries on the right bank (Gorouol, Dargol, Sirba, Goroubi, Diamangou, Tapoa, Mékrou); and (ii) the left bank tributaries composed of fossil valleys (Bosso, Maouri and Fogha dallols) which can have seasonal water courses.

In terms of groundwater, the study area is connected to the Beninese part of the Iullemeden aquifer system, of which it forms an outlet to the Niger River. The following four aquifers are in the project area: the continental intercalary /hamidian aquifer, the aquifer of lower continental terminal sands and the unconfined continental terminal and alluvial deposits. The findings of the water analyses show that the physico-chemical quality of the groundwater sampled is acceptable.
Nigeria

The entire project area is drained by the Sokoto River which is the region’s main river and a tributary of the Niger River. The Sokoto River with its main tributaries, the Ka River, Zamfara River and Rima River rises in the mountainous areas of Mashika and Dunia at an elevation of 600 to 900 metres bordering the eastern part of the basin and flows downwards fairly slowly on a gentle slope towards the north-west where the town of Sokoto is located. It is joined by the Rima to the north, swinging to the south, gathering the Zamfara and Ka before flowing into the Niger River. In the eastern source areas, the Sokoto River system is only seasonal. However, in the western parts of the basin, the river becomes perennial when it begins to receive a significant groundwater inflow.

4.2 Biological Environment

4.2.1 Flora

Benin

The phyto-geographical area in which the study area is located is characterized by a mosaic of woody, tree, shrub and grass savannah dotted with agricultural mosaics and marshy areas. Inhabited areas as well as farmland encroach on these natural formations. The types of habitats in the study area mainly comprise agricultural mosaics with some plots of vegetation and some stunted forest stands. The study area mainly comprises modified terrestrial habitats of limited ecological interest. A total of 50 floristic species have been identified in the study area: (i) 13 species of trees from 10 families including 5 species designated as vulnerable by the IUCN (the lingue, African ebony, shea tree, cailcedrat tree and the false mahogany tree). One species of tree, the moringa (Moringa oleifera), also appears in the endangered species register of IUCN. In the national classification of threatened species, 2 species are vulnerable (the shea tree and the doub palm) and 3 species are endangered (the lingue, cailcedrat and false mahogany); (ii) 12 species of shrubs in 8 families have been identified. The most representative family is the Fabaceae (Leguminosae), especially the Mimosoideae sub-family; (iii) Grasses are the most diversified type of floristic species with 24 species identified in 11 families mainly from the Poaceae family. There is also one type of liana of the ipomea genus (Ipomoea spp.), designated as vulnerable according to the IUCN. 25 of the 50 floristic species identified in the study area provide services for the population and have utility value. The African baobab (Adansonia digitata), the doub palm (Borassus aethiopium) and shea tree (Vitellaria paradoxa) are three trees with the highest utility value.

Burkina Faso

The study area lies completely in the West Sudanese savannah ecoregion. The terrestrial habitats are tree, shrub and grass savannahs, forest plantations, crops and agroforestry territories. The aquatic habitats or those associated with water are humid zones, rivers and water bodies as well as gallery forests.

Niger

The study area lies completely in the West Sudanese savannah ecoregion. The terrestrial habitats are forest ecosystems (stripped bush and classified forest) and agricultural ecosystems (agricultural systems). The aquatic habitats which were the subject of this work in the study area comprise continental water ecosystems, lentic ecosystems of calm, slowly replenished water (ponds observed in dallols) or lotic ecosystems of flowing water (Niger River mainly at the level of Tara and Say especially at Tilli Kollo and Tahirou Koara).

On the whole, the samples taken during the humid season including 126 grassy species and 50 woody species have been identified and grouped in 122 genera and 46 families. The most representative families are the Poaceae with 25 species i.e. 14 % of the floristic biodiversity inventories followed by the Fabaceae with 14 species, i.e. 8%. In all the samples taken in the dry season in humid zone habitats especially around the Bosso and Maouri Dallol ponds, the Niger River Valley habitats and in the ponds at the Makalondi District IBA have
resulted in the identification of about 103 species. These species are broken down into 28 families and 71 genera. The most representative families are the Poaceae followed by Fabaceae, Cyperaceae and Convolvulaceae. 17 of the species identified are vulnerable at national level and one species, *Vitellaria paradoxa*, is on the IUCN’s red list as vulnerable.

**Nigeria**

In Nigeria, the study area lies completely in the West Sudanese savannah ecoregion. The main feature of the area is human presence resulting in a relatively degraded level of natural habitat with significant intensive cropping and agricultural mosaics. The sub-station environment is mainly degraded and comprises a few planted trees; Azadirachta Indica (Neem), Mangifera, Indica (Mango tree), Anarcadium Occidentalis (cashew tree) and a significant Sida Cordifolia community. The only natural terrestrial habitat is the striped bush which is chiefly found close to the Niger border.

The striped bush is a community of plants with foliage comprising alternating strips of trees or shrubs separated by bare soil or thin grassy cover which runs almost parallel to the contour lines of equal elevations.

**4.2.2 Fauna**

**Benin**

Five species of amphibians have been identified one of which, *Hyperolius torrentis*, is critically endangered. The four other amphibious species have minor concern status. Twelve species of reptiles from six families have been identified. The most representative are pythons (Pythonidae) and vipers (Viperidae). Two species of python (the royal python and the Seeba python) are partly protected under national law (category B). Two species of crocodile (the slender-snouted crocodile and the Nile crocodile) colonize water points in the study area. The slender-snouted crocodile is on the national list of endangered species, and the Nile crocodile has been designated as vulnerable. These two species also have the status of fully protected species in Benin, (category A). The savannah monitor (*Varanus exanthematicus*), of minor concern according to IUCN, is also present. The study area has the potential to host 38 bird species. These species include the African vulture which is on the IUCN list of critically endangered species and is fully protected in Benin. According to IUCN the lappet-faced vulture is also threatened. Two species (the crowned crane and the secretary bird) have vulnerable species status. Nation-wide, thirteen other sensitive species have ‘vulnerable’ or ‘critically endangered’ status, including anatidae (3 species) and circomidae (4 species). The threats to these species generally come from hunting and poaching as well as the degradation and loss of habitat. Two species of mammals (the African elephant and hippopotamus) have been identified in the study area. These two species are on the IUCN’s and Benin’s list of vulnerable species. In addition, 44 other species may be found in the study area, in particular, the sea cow which is recognized as a vulnerable species according to IUCN but also many murids (23 species) and bats (12 species).

**Burkina Faso**

The inventories carried out along the power transmission line have resulted in the identification of 32 species of mammals in 19 families. The most represented category of mammals include the bovidae with 19%, Felidae (11%), Canidae (7%), Herpestidae (7%). Three species listed during the inventories are recognized as critically endangered according to IUCN, namely the elephant (*Loxodonta africana*), the ourebi (*Ourebia ourebi*) and lion (*Panthera leo*).

**Niger**

One species of amphibian of the eight (8) species potentially present has been found in the IBA zone. It is *Amietophrynus regularis* a member of the bufonidae family. All the species present or potentially present have minor concern status according to IUCN. With regard to reptiles, 11 species have been observed in the field.
and 27 are potentially present in the study area. In particular, the snake of the colubridae family (Dasypeltis scabra), a critically endangered species has been observed in the river zone. The presence of the Nile monitor (Varanus niloticus) has been reported by the communities in the study area though none had been observed. During the rainy season 21 bird species have been identified only 3 of which are migratory: the sandpiper (Actitis hypoleucos), spotted redshank (Tringa erythropus) and the marsh harrier (Circus aeruginosus). The resident species, the cattle egret (Bubulcus ibis), is the most dominant with 100 out of a total of 305 birds identified. At the start of the migratory season, a total of 36 species were identified 18 of which are resident and 18 wintering.

Overall, in the study area, fauna mainly comprises small mammals given the overall integrity of habitats. Small wildlife present or potentially present in the study area comprises 31 species mainly small rodents and bats. One of the latter is recognized as being threatened according to IUCN, namely the African straw-coloured fruit bat (Eidolon helvum). The inventories have confirmed the presence of the Niger giraffe (Giraffa camelopardalis peralta), the hippopotamus (Hippopotamus amphibious) and sea cow (Trichechus manatus). Niger’s giraffe sub-species (Giraffa camelopardalis peralta), an emblematic species is considered to be critically endangered according to the IUCN red list.

Nigeria

With regard to herpetofauna, a total of 41 amphibians of three different species were identified during the rainy season while 104 reptiles belonging to 5 different species have been recorded. The numbers declined during the dry season when only 14 individual amphibians and 82 reptiles were recorded. Rana Temporaria has the highest relative density among the species identified (57.14) during the dry season. However, it was only present on one site. None of the species observed are on the IUCN red list of threatened species.

Fourteen (14) species belonging to eleven (11) families of birds were identified. There was a clear indication that the diversity of these birds was fostered because of the available water and the variety of food mainly in the rainy season compared to the dry season when the number of occurrences declines. Species density showed that Zenaida Auriculata has the highest density of all species both in the rainy season (29.02%) and in the dry season (30.30%).

4.2.3 Protected Area

Benin

The study area does not cross any protected area. The W park, the Djona hunting reserve and the Gougoun classified forest are however close by. The study area mainly comprises modified terrestrial habitats of limited ecological interest. There is one main habitat in the study area, the Niger River which is the preferred site for the displacement of avian fauna, in particular, water birds. Moreover, the aquatic habitats of the river host about 130 to 140 species of fish (Daget, 1954). As the only permanent water course in the area, the river plays a critical role for animals which depend on aquatic environments.

Burkina Faso

The line’s route crosses the Gonsé classified forest in Saaba rural municipality in Kadiogo province, 25 km from Ouagadougou on National Road 4. The vegetation is characterized by savannah-type flora comprising Combretaceae and Acacias. The most dominant taxons are: Combretum micranthum, C. glutinosum, C. nigricans, Anogeissus leiocarpa, Accacia dudgeonii, A. macrostachya, A. gourmaensis etc. Grassy flora comprising Andropogoneae is often associated with these species.
Niger

W National Park

The W regional park covers an area of 1,024,280 ha on the borders of Benin, Burkina Faso and Niger. It lies between 11° and 12°35 latitude North and 2° and 3°50 longitude east. The W park supervised under Niger legislation is located in the northern part of the cross-border park about 150 km south-west of Niamey. It was established in 1954 and covers an area of 226,000 ha and is protected by international conventions such as the CITES Convention or the Washington Convention, the Algiers Convention on the Conservation of Nature and Natural Resources ..., the UNESCO World Heritage Convention and the RAMSAR Convention on Wetlands of International Importance. The study area forms part of the Sudanese –Guinean Sector of Trochain (1940) and falls within Category III (Sudanese Regional Centre of Endemism) of undifferentiated Sudanese open forest and woody, tree and shrub savannah.

Tamou Total Wildlife Reserve

The Tamou Total Wildlife Reserve covering an area of 76,000 ha was established on 8 August 1962. It is located in the south-western part of Niger and administratively forms part of Tamou rural municipality in Say Department (Tillaberi region). It lies between latitude 12° 28’ and 12° 50’ north and longitude 2° 06’ and 2° 24’. It is bordered by the Diamangou River to the North, Burkina Faso to the west, the W national park to the south and the Ayinoma zone to the east.

Dosso Partial Wildlife Reserve

The Dosso Partial Wildlife Reserve was established on 9 August 1962 and covers an area of 306,000 ha. This reserve is located entirely in south-west Niger in Dosso Region. It is part of Niger’s most watered area. From and agro-ecological standpoint, it forms part of the north Sudanese zone and lies mainly on geological formations of the Continental Terminal. On the uncultivated plateaus there is a mosaic of striped bush with a linear structure, a diffuse structure and an intermediate structure. This type of vegetation also called thicket vegetation is characterized by strips of bare soil and vegetation, which gives it a special structure which satellite images show to resemble a tiger’s skin hence the name striped bush. In the strips of vegetation, *Combretum micranthum* is the dominant species, tufts of which form the thicket. At the centre of this thicket there are *Combretum nigricans* plants and on the periphery, the *Guiera senegalensis* species forms a dense network. The other species are generally found on the periphery of the thicket.

Gourou-Bassounga Classified Forest

In the Nord-Sudanese zone of Niger, the Gourou-Bassounga forest (9,970 ha) is located in the far south of Niger, almost on its border with Benin. Administratively, the forest is adjacent to the town of Gaya, headquarters of Gaya Department in Dosso Region. This province provides the town of Gaya in Niger with wood and the town of Malanville in Benin.

Fera Classified Forest

The Fera classified forest is located in the Torodi and Makalondi zone, 20 km from Torodi on the Niger-Burkina section on latitude 1° 46’ 54.2544” and longitude 12° 58’ 11.64”. It lies on the Continental Terminal dominated by sandstone formations often intruded by granite blocks that constitute an outcrop of the bedrock. It is composed of plant formations of the striped type. The dominant species is *Combretum micanthum* which forms dense thickets.
**Djandjandiori and Panoma Village Forests**

These village forests are located in Makalondi rural municipality. According to their respective development plans, Djandjandiori and Panoma forests constitute a forest area of 644.58 ha and 2,133.64 ha. These forests are intended for exploitation by the rural municipalities with which they are associated. The forest stands mainly comprise combretaceae. However, only four species were designated for felling: *Combretum nigricans, Combretum micranthum, Guiera senegalensis* and *Combretum glutinosum*. Felling plots have been designated in these forests where annual quotas are specified in the development plan. Clear felling rules have been established.

**Bosso Dallol RAMSAR Site**

The Bosso Dallol is an ancient valley of a fossilized tributary of the Niger River. The source of this now inactive water course is from the network of koris that drain the south-west of Air and Talak. The Bosso Dallol lies in a 775 km long depression but its course is discontinued for distances of 30 to 125 km. This valley with its 22 km² watershed has a near-surface aquifer: the water table is generally to be found at less than 10 metres. During the dry season, the Bosso Dallol valley comprises a group of perennial ponds which are interconnected during the rainy season. The presence of these ponds of perennial water constitutes an ecosystem of high ecological interest containing distinct vegetation mainly comprising *Parinari macrophylla, Acacia albida, Detaria microcarpum, Borassus aethiopum, Hyphaene thebaica, Vitellaria paradoxa* and *Parkia biglobosa*, some of which are threatened species. It also hosts Niger’s giraffe population (*Giraffa camelopardalis peralta*).

**Maouri Dallol RAMSAR Site**

The Maouri Dallol is a fossil tributary of the Niger River and is the lowest extension of the Tadiss Valley (located in Niger’s Tahoua Region). The wettest part of the Maouri Dallol is characterized by a temporary flow in the rainy season and the maintenance of a group of ponds in the dry season. This dynamic ensures the maintenance of a diversity of habitats that fosters the region’s fauna and floristic diversity. It also provides support to several socio-economic activities of the sector concerned. The Maouri Dallol’s humid zone designated as a RAMSAR site is a rare, if not unique example of West Africa’s Sudanese-Sahelian biogeographical area. This fossil valley maintains a complex of exceptional vegetation (*Borassus aethiopum, Hyphaene thebaica*) watered by the resurgence of phreatic and fossil water tables and by rainy season water flow. It has become a refuge for *Borassus aethiopum* whose distribution area is limited.

**Major Bird Conservation Area in Makalondi District**

In Niger, the proposed route of the power transmission line crosses a major area for bird conservation which is also a key biodiversity area, namely, the Makalondi District *Birdlife* Data and its partners which are responsible for the IBA programme. With 12,000 sites across the planet the IBAs represent the world’s largest network of sites of biological importance. They are identified on the basis of the importance of specific criteria relating to the importance of the site the protection of threatened species, species of great importance for conservation, for the concentration of individual birds during migration, reproduction etc. or even whether the site hosts rare and threatened plant communities. *Conservation International* and its partners, including *Birdlife*, have also identified this area as a key biodiversity area (KBA), more specifically bird biodiversity. The KBAs are the most important sites for the conservation of global biodiversity.

**Nigeria**

There is no protected area in the project area.
4.3 Human Environment

Benin

In 2013, Malanville municipality had a population of 168,641 people according to the 4th General Population and Housing Census (GPHC 4, National Institute of Statistics and Economic Analysis, 2013) with a 4.57% growth rate between 2002 and 2013 and an estimated density of 45 inhabitants/km². The male/female distribution is almost equal (50.4% for women compared to 49.6% for men).

The literacy rate in Malanville municipality was 10.5% in 2002 according to the findings of the 3rd General Populations and Housing Census (GPHC) in 2002 carried out by the National Institute of Statistics and Economic Analysis. It was respectively 14.8% for men and 6.4% for women with a gender parity index of 0.43. Women are, therefore, the largest illiteracy target in the municipality.

In Benin’s health structure, Malanville municipality is part of the health zone comprising the municipalities of Malanville and Karimama. According to 2011 data for the Departments of Borgou and Alibori, Alibori Department had the following indicators over the 2002 to 2012 period: a 12.85‰ mortality rate compared to a national average of 12.27‰; an infant mortality rate of 84‰ compared to a national average of 90‰; a birth rate of 47.7‰ compared to a national average of 41.17‰; and life expectancy at birth of 55.27 years compared to a national average of 59.2 years.

Malanville municipality has a low drinking water coverage rate which is unevenly distributed between sub-districts as well as between localities in the same sub-district. The town of Malanville also has a low coverage rate by the SONEB network which only stretches 18,739 linear metres with 479 household subscribers.

Workforce distribution by sector of activity in the municipality indicates that the tertiary sector (trading, restaurant-hotels, transport-communication and other services) alone employs over half the workforce. Agriculture, livestock and fisheries which constitute the primary sector, use a little less than one third, and the secondary sector 15% of the workforce. The municipality depends heavily on agriculture but that sector competes with the commercial sector.

Several households in the project area have a higher level of vulnerability due to the characteristics of some household members. Several households are headed by women. Furthermore, some household heads are not only women but also widows. Some household heads are also struggling because of disability or chronic disease. Several households also have one of their members other than the head who are disabled. Finally, over 85% of households affected in each of the villages concerned have no other plots than those crossed by the right-of-way. Indeed, of the 52 project-affected households, only six (6) have a plot other than the one located in the right-of-way.

Burkina Faso

The four (4) regions that make up the project area fall within the regions of the administrative area: Centre, Centre-East, East and Central Plateau. The proposed route for the interconnection line crosses 11 municipalities. The East region is the most frequently crossed with effectively two (2) provinces, five (5) municipalities and 30 villages/sectors concerned. The Centre and Central Plateau regions are the least affected with respectively one (1) municipality and seven (7) villages/sectors crossed in the first case compared to two (2) municipalities and nine (9) villages/sectors crossed in the second case.

The population is mainly rural majority. The Centre region, is, however, for the most part urban and includes, in particular, Ouagadougou, the country’s capital and main city. 38.98% of the project area’s total population is concentrated in this area. Overall, the project area is overpopulated, with an average population density of 65.425 people per km², significantly above the national average which is 51.4 inhabitants per km². However, it should be noted that, with the exception of the East region which has a density (25.96) below the national average, the other three regions have levels that exceed it (Centre 602.21, Centre-East 76.95 and Central Plateau 107.03).
The main economic activities of the workforce concern agriculture, stockbreeding and fishing (79.2% of employed people), service and trading activities 9.3% and those employing artisanal and other workers 5.6%.

In general, the main sources of water supply are boreholes/pumps, wells and standpipes. Transportation is being rapidly developed despite organizational weaknesses and inadequate infrastructure. National Road 4 runs along most of the project area. SONABEL’s 2015 data showed that 19% of the country’s households had access to electricity.

While there are no protected historical sites or monuments known to-date in the project right-of-way, various sites for special use are to be found in the municipalities crossed by the line.

**Archaeological Sites**

Almost all villages and hamlets have their sacred sites. The best known are located to the east of the project area (East and Centre-East regions). Seven (7) of the communities crossed by the 330kv line section have sacred sites which will be passed over by the line and another seven (7) have sites that will be by-passed (since they cannot be decentralized or displaced). All the communities will receive compensation for carrying out deconsecration and displacement of the first sites and protection of the second group. Furthermore, the power line will pass over two (2) cemeteries and be provided with the necessary materials (e.g. wire-mesh fencing) to protect them.

**Niger**

The project straddles the three (3) regions of Dosso, Tillaberi and Niamey which respectively, according to the same census, have populations of 2,141,487 and 2,645,125 and 1,388,682 inhabitants. The study area has a largely rural population representing 89% and 94% of the total populations of the Dosso and Tillabéri regions. The population of Niamey is, for its part, urban.

In general, Niger has some population mobility in both the interior and exterior of the country often linked to natural circumstances dictated by climatic conditions. Internal migration is usually seasonal and also occurs towards the major urban areas (Niamey, Dosso, Gaya Torodi), as well as towards some areas of attraction such as the gold mining sites in the Sirba area where there are job opportunities for young people (men and women). On the basis of the season calendar which maps out the activities of the different social strata of the population, it was identified that the segment of people most prone to migratory movements remains youth between 15 and 40 years old. These migratory movements are normally cases of annual or multi-year migrations. This youth migration is largely due to idleness and limited job prospects.

Considerable progress has been made in Niger in the field of education, especially concerning primary education. The gross enrolment rate made significant progress over the 2007-2008 to 2010-2011 period. Over that period, the rate rose from 62.6% to 76.1% i.e. an increase of 13.5 percentage points. However, this increase conceals wide disparities between boys and girls (17.6 percentage point bias against girls) and environments (19.1% point bias against the rural environment). In 2014, the gross enrolment rates recorded in the project area ranked the region of Niamey highest in the classification with 113.9% followed by Dosso with 75.2% and Tillabery with 71% compared to a national rate of 76.1% according to the INS on the basis of the education report. As in the case of environments or gender, disparities were also noted between regions even though such disparities were reduced between 2009-10 and 2010-11. In terms of health, current morbidity and mortality indicators (including the mortality rate, infant mortality rate, life expectancy, birth rate, etc.) provide information on the population’s general health status in the area of intervention of the Integrated Agricultural Development and Climate Change Adaptation Programme in the Niger Basin. This level is worrisome from several standpoints and, to a certain extent, reflects the scale of demand in terms of health care in particular for the most disadvantaged and most vulnerable segments of the population. According to the INS, with regard to HIV/AIDS, it was noted that the prevalence rate is 0.5% for the Dosso region, 0.2% for Tillabéry and 1.1% for Niamey, while, at national level, it is 0.4%.
On the economic front, Niger’s agriculture is dominated by rain-fed production focused on cereal and tuber associations. It is practised in the south and provides a living for almost three quarters of the total population. Agriculture is, therefore, the main economic activity carried out by the inhabitants of the study area. The main crops grown in the area are: millet, sorghum, cowpeas and groundnuts. The respective production rates for these crops in the project area are 60 %, 10 %, 23 % and 2 %.

Nigeria

The study area is located in Kebbi State. The 2011 projections give 3,630,931 inhabitants, with a population density of 56 inhabitants / km². With 78%, the rural population comprises the majority of the population.

In 2013, literacy was determined by assessing the respondent’s ability to read part or all of a sentence. Only women and men who had never attended school and those who had not completed primary education were asked to read the cards (in the language that they were most likely to be able to read). Those who had received secondary or higher education were assumed to be literate.

Oil has been one of the main sources of public revenue since the 1970s, but regulatory constraints and security risks have limited new investments in the oil and natural gas sector. However, Nigeria’s economy continues to grow rapidly at an annual rate of 6-8% due to growth in agriculture, telecommunications and services. With over 75% of the State’s population living in rural areas, agriculture is the main occupation in Kebbi State. Many of its citizens also carry out agricultural activities to supplement their incomes.

Most of Kebbi State’s population uses protected or unprotected sources for water supply. The findings for the 498 households concerned by the project showed the vast majority (88.8%) obtain their domestic water from a well.

Only one third (37.3%) of the 498 households concerned are connected to the electricity grid. They mainly use electricity for lighting.

Kebbi State’s health system is overburdened by a rapidly growing population, obsolete physical installations and equipment, with a scarcity of qualified health workers. In addition, stakeholders’ roles are badly aligned and coordination systems are weak. This situation is exacerbated by a shortage of data which raises a challenge for evidence-based planning policy as well as the formulation and allocation of resources and health system management.

The Hausa society of which Kebbi State is part, is patriarchal with a strong male influence on all walks of life. Women who are isolated are generally considered as dependents, subject to their husband and their life assumed to be limited to the domestic sphere. They have very little freedom to take their own decisions without the authorization of men. It is because of the nature of the system which places the responsibility for spouses and their children on husbands that women should remain isolated and carry out domestic chores. Men, not women, by convention, take part in public life and monopolize public affairs.

5. ANALYSIS OF ALTERNATIVES

5.1 Do-nothing Option

It is important to consider the do-nothing option. This maintains the status quo where no power line would be constructed to establish interconnections with the other countries of West Africa. This option would call into question the project’s objectives. However, since Benin is unable to meet its national demand, power exchanges with the other WAPP countries are of strategic importance. In the North of Benin, SBEE is working in collaboration with ABERME to develop the 33kV network between localities and to attempt to connect the new loads and remote places. The inability to meet demand may also considerably impede the country’s economic and social development.
5.2 Technological Options

The technological options considered to provide supply that will meet demand mainly comprise: (i) the development of new sources of electric power generation (hydro-thermal and solar power) combined with that of the national transmission and distribution grid; (ii) development of interconnection with neighbouring producer countries and providing affordable access to electricity; (iii) a combination of the development of new production sources and interconnection projects. The technological option of interconnection links is currently favoured while pursuing the preparation and development of complementary power generation projects.

5.3 Selection of Equipment

The technical elements of the equipment intended to provide the interconnection links which were the subject of options mainly concern two aspects of the transmission line, i.e. the number of circuits and the type of conductors to be preferred. The other aspects associated with the transmission line were not the subject of any options for the following reasons: (i) Voltage: was maintained at 330 kV in order to comply with the existing capacities of the networks already installed in the different countries concerned by the project, in particular, in Benin; (ii) Number of pylons and the nature of their foundations: it was decided only to propose design criteria based on the main desired characteristics in order to leave some leeway for possible suppliers to consider the different options and thus minimize their costs.

5.4 Analysis of Variants

The route identification method uses optimization principles in order to identify the route with the best compromise between the many social, environmental and economic criteria while ensuring compliance with local, regional and national development plans as well as the guidelines issued by the electric power utilities in each country concerned by the project. The straight line between two transformer sub-stations is the most interesting solution to minimize the length of the line to be constructed and minimize the footprint. However, this type of solution is not often possible, for the technical constraints and needs of the populations and the need to protect the environment often conflict with each other and cause the line to deviate. The route options were developed on the basis of consideration of certain environmental and social constraints as well as the optimization of areas with weaker impacts. A power transmission line is, therefore, positioned in a process of compromise taking specific criteria into consideration. WSP has prepared a list of criteria to determine the line’s route and explore all possible solutions.

In accordance with the mission Terms of Reference, the route’s general characteristics considered are as follows:

- Short, to minimize costs and environmental impact;
- Rectilinear, to minimize angles and footprint on the ground;
- Accessible, therefore close to roads to facilitate maintenance;
- Close to towns and villages to facilitate their electrification;
- Bypassing of towns and villages in order to minimize the demolition of buildings and the resettlement of populations.

The elements to be avoided are: (i) airport and aerodrome exclusion areas; (ii) soils with low bearing capacity therefore far from humid environments and flood-prone areas; (iii) hills and crests; (iv) protected areas, forest reserves, classified forests, RAMSAR sites and other sites intended to protect the natural environment and species.
The identification of alternative routes aimed to meet the criteria presented above and to reach the best compromise whenever the solutions clashed with each other. The design of route options as well as site environment were carried out simultaneously in order to maximize feedback between the two processes and allow the exploration of the maximum number of alternatives. The method used to generate alternative routes is based on an iterative approach. In general terms, WSP first assessed over a wide geographical area several potential routes and subsequently gradually specified them. The main stages of the procedure are as follows:

**Stage 1:** Identification of routes in an analytical corridor of 10km around the Fichtner reference route. The routes were drawn using mapping optimization on the basis of scenarios taking into account existing infrastructure and environmental and social constraints obtained from a literature review.

**Stage 2:** On the basis of the route options generated in the previous stage, the mapping of environmental and social components was carried out in a 10 km corridor. This mapping was carried out by photographic interpretation of satellite images in which, in particular, villages, military bases, national roads, power transmission lines, airports, major water courses, flood-prone areas, sloping areas, plantations, pastoral areas, protected areas key areas for bird protections, key biodiversity areas, Volta Valley irrigation schemes and RAMSAR sites were identified. The route options were then optimized in order to avoid as many obstacles as possible and take advantage of route opportunities in places with greater impact.

**Stage 3:** WSP’s transmission line experts assessed the route options in order to anticipate the project’s technical constraints. The options were also submitted to the electricity companies of each country concerned (NIGELEC, SONABEL, CEB, TCN) during working sessions held in March and April 2015. The developers proposed modifications which were considered.

**Stage 4:** On the basis of options stemming from the previous stages, detailed mapping in the 80 metre right-of-way of the two options was carried out. The aim of this mapping was to identify concessions, buildings, access roads, tracks, streams, forest, savannah land, flood-prone areas, erosion areas, plantations, agricultural and subsistence sites. The options were thus modified in relation to the mapping results at this stage. On the basis of all the mapping elements at this stage, the main challenges as well as areas with major constraints were identified and localized.

**Stage 5:** The different route options prepared as well as the Fichtner option were compared on the basis of a multi-criteria analysis. The analysis makes it possible to identify the route option resulting in the least impact on the environment, social environment and project costs.

**Stage 6:** This stage includes the mission to examine the provisional route selected. This mission was fielded in June 2015 as were all consultations with regional and national authorities in order to gather comments on the feasibility of the preliminary route option proposed. The preliminary inspection mission of the provisional route was able to verify the validity of the mapping components to characterize the different areas with major constraints and identify alternatives backed by knowledge of the local environment.

**Stage 7:** A workshop on the preliminary examination of the provisional route from 8 to 10 July 2015 in Cotonou, comprised representatives of WAPP, electricity companies Ministries of Environment of the countries and WSP. On the basis of the results of this workshop and the incorporation of all the comments gathered, the preliminary provisional route was optimized. This optimized route was the subject of a comparative analysis based on the mapping criteria. All the results of these stages are to be found in this final provisional report of the proposed line’s route.

**Stage 8:** Following the conduct of the ESIA, comprising a more detailed characterization and analysis of the environmental and social components as well as the assessment of the impacts associated with the project, the final provisional route will be optimized in order to identify the final route.
The multi-criteria mathematical analysis method (MMAM), a quantitative tool, was used to compare the line route options. MMAM is a method designed to assess the alternatives on the basis of criteria which are measured in units of different measures.

<table>
<thead>
<tr>
<th>CRITERION</th>
<th>UNIT</th>
<th>IMPORTANCE</th>
<th>VALUE</th>
<th>WEIGHT (%)</th>
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</thead>
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<td></td>
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<td>5</td>
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</table>

**Option 1**

**Nigeria (50 km)**

Option 1 originating in Dosso (Niger) enters Nigeria 4 km west of Amagoro and runs in a south-east direction over fairly flat savannah land to link up with the existing 132 kV line, 8 km east of Ungwan Rafi.

**Niger (456 km)**

Option 1 favours the crossing of the Niger River at a narrowing area and connects with the Niamey sub-station at Diawando. It exits the proposed Niamey sub-station to the south-west and crosses the Niger River close to Tahirou Koira, where the required span for the crossing is 430 metres in the dry season. Then, for 42 km it crosses flat savannah land and, near Siawando, connects with the existing 132kV line and National Road 1. It skirts them by the south and enters the Bosso Dallo RAMSAR site for 37 km.

**Burkina Faso (363 km)**

From the Ouagadougou sub-station, option 1 runs north along National Road 4 mainly through savannah and forests. This option has the advantage of being easily accessible by the National Road and crossing an already disturbed environment but which is also inhabited. It also bypasses the classified forests of Gonse, Nakambe and Wayen.

**Benin (13 km)**

The Benin route only has one option. Route options for entering Benin are limited. The Gourou-Bassounga forest, the presence of the airport at Gonga Karima and a heavily built environment indicate a route penetrating to the West of Malanville. This option runs to the border with Niger and crosses the Niger River 4 km north-
west of Malanville. It continues through paddy fields along the Niger River and bypasses Malanville in a south-west direction over 5 km of savannah. The route passes to the west of a flood-prone stretch of the Niger River crossing rice fields and bypasses Badjékali to the west. Finally, the route joins the RNIE 2 and the projected Malanville sub-station, 3 km south of Badjékali. The 13 km route will mainly impact on agricultural areas and also cross flood-prone areas.

Option 2

Nigeria (58 km)

Option 2 originating in Zabori (NE) enters Nigeria 11 km west of Kaingiwa and runs along the south of the existing line, crossing a few hilly areas. In order to avoid the exclusion zone 2km around Kaingiwa airport, for about 9km the route leaves the existing line which is in the exclusion area. The route then follows the existing line then reaches the eastern part of the flood-prone area of the Sokoto River before reaching the Birnin Kebbi sub-station.

Niger (422 km)

In order to link the Niamey sub-station with Diawando to the east, option 2 follows the existing power line but crosses a stretch of the river that is wider than in the case of option 1. Option 2 leaves the Niamey sub-station towards the north-east crossing built environments, then the Niger River with a span of 510 m in the dry season. On the eastern bank of the Niger River, the line runs along and crosses the existing 330kV and 132kV lines in a built environment, which could have more serious impacts. The route then follows the existing power line by the south and reaches Diawando. As in the case of option 1, near Diawando, it runs along National Road 1 and the existing 132 kV power line by the south, penetrating 37km into the Bosso Dallol Ramsar Site.

Burkina Faso (379 km)

Option 2 differs from option 1 on the Ouagadougou – Ganzourgou section bypassing 11 km to the south and runs along the existing 132 kV line (Ouagadougou – Bagré Dam), crossing 52km of the Nakambe classified forest, then by leaving the line in a north-east direction before reaching Ganzourgou via Manésé Benin (13 km). As mentioned above, the Beninese route only has one option for linking it to Niger. Option 2 therefore follows option 1 described above.

Option 1 represents the optimal route on the basis of the selected criteria. Though it is longer, it more effectively avoids the existing environmental and social constraints. Also, the additional costs associated with its length are compensated by greater accessibility over a large part of the route and also by an optimal site for the Niger River crossing, which limits technical constraints and associated costs.

<table>
<thead>
<tr>
<th>CRITERION</th>
<th>WEIGHT (%)</th>
<th>OPTION 1</th>
<th>OPTION 2</th>
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<td>Ranking</td>
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<td>2</td>
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</tbody>
</table>

Route Modifications following Completion of the ESIA and RAP

In Niger, and in Burkina Faso, some route adjustments were made to take into account specific factors gathered during the field inventory work. In Niger, the route was modified at Nigelec’s request to avoid housing located south-west of the town of Dosso. The diversion is about 35 km long. It leaves the existing route to the south just before the village of Kounmo-Koye-Deye, at about 12 km from Dosso and joins the original route straight ahead, 19 km from Dosso and 7 km from the town of Birni Ngaoure. In Burkina Faso, Sonebel
wanted the two facilities that had been identified during the inventories to be avoided i.e. the bypassing of a school in Wakou and a sports ground in Koupela. With regard to the sacred sites, SONABEL requested that they all be avoided. Minor adjustments will, therefore, be made to the provisional line to bypass about a dozen sites scattered along the route.
6. POTENTIAL IMPACTS, MITIGATION AND ENHANCEMENT MEASURES

6.1 Direct Negative Impacts

6.1.1 Site Preparation and Construction Work Phase

6.1.1.1 Biophysical Environment

The main impacts are summarized below:

- **Impact on air quality and on noise levels**: In the construction phase, several activities such as the construction of access roads, levelling/earthworks and/or the transportation of materials carried out simultaneously could cause a local increase in the concentration of fine particles in the air. The use of machinery will also cause exhaust emissions which will increase air pollutant concentrations. It is, however, considered to be minor. The same applies to noise whose levels will rise during the works but will remain below accepted standards. In general, there is no specific problem in terms of noise in the study area given that, according to the sampling carried out, external noise does not exceed 55 dB(A) in accordance with WHO recommendations.

- **Impacts on soil structure**: During the construction phase, the works required to lay the foundations for the pylons (e.g.: forest clearing, excavations) as well as those required for the construction of access roads are likely to cause soil erosion especially in erosion-sensitive areas (e.g.: slopes and hills). However, since the study area’s topography is characterized by gentle slopes, the risk of soil erosion should remain low, especially as mitigation measures aimed at reducing soil erosion will be taken during the construction phase. The construction of access roads and movement of machinery in the study area may result in soil compaction in places where soils are clayey or highly saturated.

- **Impacts on water resources**: Water-related works as well as the management of hazardous products and residual materials result in local changes in hydrological conditions and alterations to the physico-chemical parameters of surface water and the risk of contamination. In Benin, the route crosses a major water course, namely the Niger River, 4 km north-west of Malanville. The route also crosses the river’s flood plain which is particularly used for agricultural purposes. In Burkina Faso, the route crosses several perennial or intermittent water courses as well as flood-prone areas, one of which lies 1 km north-east of Gampéla, to the north of National Road 4 as well as a second 4 km north of Tanwolbougou, 2km of which is crossed. In Niger, the route crosses a major perennial water course, namely the Niger River close to the border with Benin. The route also crosses several left bank tributaries of that river which are composed of fossil valleys (Bosso, Maouri and Fogha Dallols) that could have seasonal water courses. In addition, perennial ponds are observed here and there within these fossil valleys. Some of these ponds may be crossed by the power line. In Nigeria, the proposed line crosses one main water course, the Sokoto River, as well as several intermittent water courses. The proposed line crosses over 8 km of the Sokoto River flood plain.

- **Impacts on flora**: In Benin, the construction of the power line will require the clearing of vegetation along a 12 km long and 50-metre-wide corridor. For the most part the right-of-way is made up of agricultural areas comprising the agroforestry mosaic, rice fields and the agricultural development area as well as market gardening areas which account for 74.36 % of the right-of-way. There are also 12.84 ha of shrub savannah within the right-of-way. In Burkina Faso, construction of the power line will require the clearing of vegetation along a 381 km long by 50 m wide corridor. The line will also cross 3 km of the Gonsé classified forest with a total right-of-way of 15 ha. The dendrometric analyses carried out at forest level determined the density per hectare equivalent to 1,118.3 trees per hectare. Consequently, approximately 16,775 trees could be felled for devegetation works on the right-of-way at the level of this forest. On the section of the 330 kV line, 12,309 trees will be affected while on the sections of the 250 kV and 90 kV lines, 15,248 trees lie in the right-of-way. In Niger, while most soil
occupancy comprises agricultural areas (since fields exist in 63.7% of the right-of-way), dense and sparse striped bush does, however, covering 28.1% of the right-of-way. i.e. 589 ha. The right-of-way also contains strips with riparian forest vegetation. These habitats which host woody species, will be the subject of vegetation clearing. On the basis of wood density measurements obtained by the characterization of vegetation in the right-of-way, it was confirmed that 309,545 woody plants could potentially be cut during the right-of-way devegetation work. In Nigeria, construction of the power lines will require the clearing of vegetation over a 50 km long by 50 m wide corridor corresponding to an area of 310.04 ha. The majority of the right-of-way of the power line comprises agricultural areas including agricultural shelters, mosaic vegetation, farmland and intensive cropping land covering 66.9% of the right-of-way. Even the flood plain has gardening areas. However, areas used for terrestrial agriculture still host trees and shrubs. In all 29.06 ha of striped bush will be cleared.

- **Impacts on Fauna:** The construction activities will lead to losses, modifications and fragmentations of habitats for water and terrestrial birds. These losses of habitats could concern key ecological habitats for these species including feeding and nesting sites. It is also possible that such losses of habitats could affect protected and threatened species of birds inventoried in the study area such as the crowned crane, the Egyptian vulture and the Abyssinian ground hornbill. The impacts of habitat loss will be particularly severe in the case of key ecological habitats where species may concentrate, in particular, on the Bosso and Maouri Dallol RAMSAR Sites, the Makalondi IBA site as well as the Niger River. These areas host large numbers of birds.

- **Impacts on Critical Habitats**
  - **Niger Giraffe Distribution Area:** The line crosses 270 km of Niger’s giraffe distribution area. Giraffe movements are mainly concentrated to the north of National Road 1 at the level of the Bosso Dallol ponds. Indeed, the majority of the giraffe population permanently occupies 800 km² of the Kouré area comprising the Kouré plateaux and the Fandou region where giraffes are to be found during the rainy season from June to September. The line’s footprint is also concentrated in agricultural land. In fact, in its distribution area, over 75% of the types of habitat affected are agricultural fields. The project was, therefore, designed in order to mitigate as much as possible the impacts on its distribution area while complying with the impact mitigation hierarchy. The importance of the impact of the implementation of an adequate management programme is thus considered to be high.

  - **Bosso Dallol RAMSAR Site:** In order to mitigate the impacts of fragmentation and loss of habitats the preference was to follow existing linear infrastructure to cross the Bosso Dallol RAMSAR Site. The power line crosses the Bosso Dallol at the optimal point along the road and runs along the existing power line for 37 km. At this place, the land is mainly occupied by agricultural fields which mitigates the potential impacts on the existing ecological processes. This site completely overlaps the Niger Giraffe Distribution Area and is even an area of importance for the species so that the losses recorded form part of the areas allocated in the Niger Giraffe Distribution Area discussed above. No residual impact is anticipated on the components which led to the site’s classification (ponds, giraffes, fish and birds).

  - **Maouri Dallol RAMSAR Site:** The power line crosses 24 km of the Maouri Dallol site running to the south along the existing 132kV power line towards Kaingiwa (NG), mitigating the scale of the fragmentation impacts. In fact, fields occupy 86.6% of the right-of-way surface area at the level of the RAMSAR site. Existing striped bush occupies an area of 3.9 ha. The hierarchy of mitigation measures has, therefore, mitigated at source the majority of the potential impacts. During the inventories carried out at the Maouri Dallol no protected or threatened species was identified. Notwithstanding, as a precaution, the vegetation clearance works will be carried out with the assistance of a botanist who will identify the threatened species of flora. Its designation as a critical habitat is linked to its international designation as a RAMSAR site. However, the inventories revealed that no impact would be felt on the criteria on which the RAMSAR site had been selected.
- **Makalondi District IBA**: The power line crosses 50 km of the Makalondi District IBA. It is very important to note that these figures are estimates since the site boundaries are very arbitrary. On the basis of these approximate limits, almost 242.5 ha are located in the project footprint at the level of this site. The worst affected habitats are the dense striped bush (58.2 ha) and the sparse striped bush (157.7 ha) which host all the existing habitats. This area also contains the Djendjandiori and Panoma village forests with their very varied floristic diversity (132 species including 44 woody species inventoried). The tree density in the dense striped bush that it contains is the most frequently recorded along the transmission line (691.3 trees/ha). It was estimated that, within this IBA zone, 116,506 trees would be felled. Some of them are less than 4 m and could be conserved. This was classified as an IBA because of its importance for bird communities. No species with status was identified at the IBA level during the two inventory periods.

- **Dosso Partial Reserve**: the crossing of the Dosso Partial Reserve was preferred in order to avoid crossing the Maouri Dallol RAMSAR Site and the Gourou-Bassounga classified forest. The power line follows a secondary road and a laterite road for part of its route in order to mitigate the impacts of loss and fragmentation of habitats as well as the openings into sensitive habitats that could lead to an increase in poaching. The habitats affected by the power line are mainly areas already disturbed by agriculture. The line crosses about 64 km of it. There are, therefore, 319.9 ha within this site’s right-of-way. This site acts as a host area for certain animals (buffalos, antelopes and gazelles) of the WAP complex which crosses the Niger River during the low water period (Centre for Information Exchanges on Niger’s Biodiversity, 2015). It was identified as a critical habitat in view of its ecological link to the WAP complex.

### 6.1.1.2 Human Environment

- **Expropriation**: In Benin, a small number of houses (7) and secondary structures (1) which are located in the right-of-way will be demolished or displaced because of the route optimization work. In Burkina Faso, a number of houses (estimated at 306 on the 330 kV line section and 334 on the 250 kV and 90 kV line sections) and secondary structures (estimated at 673 on the 330 kV line section and 702 on the 250 kV and 90 kV line sections) which are located in the right-of-way will be demolished or displaced. On the 330kV line sections, 12,309 trees will be affected while on the 250 kV and 90 kV line sections there are 15,248 trees in the right-of-way. In Niger in all, in the table there are 193 main structures (179 residences and 14 businesses) and 38 secondary structures to be displaced. Most of them are located in the Tillabéri region and very few households have land outside the right-of-way on which to resettle them. There is also a tomb in the project right-of-way in the Tillabéri region. The project affects a total of 233 fruit trees belonging to PAP in the right-of-way. In Nigeria, about 26 houses, 6 secondary structures and 5 community buildings located in the right-of-way will be demolished or displaced.

- **Impact on the health of workers and local communities**: During project construction, people seeking job opportunities could temporarily swell the population. Moreover, the influx of foreign workers into local communities could heighten the risk of communicable diseases such as HIV/AIDS. Accidents are likely to occur during the construction works. Indeed construction sites pose potential risks for workers and local communities, for they may arouse curiosity especially among children. Increased traffic in villages could also represent a source of accidents. As regards the quality of life, nuisances (noise, dust air pollutions and the risk of accidents) could cause inconvenience in these rural areas.

- **Social Cohesion and Gender Relations**: the distribution of compensation among the claimants (for example owner, tenants and family members) may create tensions within and outside the affected households. The construction phase’s main impact will be on communities and social cohesion because of the presence of workers, the population’s exposure to different value systems which may conflict with their own because of the presence of different stakeholders (project administrators, sub-
contractors, employees and/or consultants); a sharp increase in monetary flows in traditional villages or the areas; the compensation mechanisms and increase in activities close to remote localities.

- **Cultural and Archaeological Heritage: In Burkina Faso**, consultations with the communities revealed the existence of some sacred sites and cemeteries in the vicinity of the proposed transmission line. The spiritual and cultural values of these elements were highlighted by the local communities. Despite diversions made to the North-Core Route as a result of these findings, some sites still remain entirely in the right-of-way or its environs. The communities of seven (7) sites have agreed that their sites be passed over by the line and another seven (7) have agreed that they be by-passed. All of them will be compensated in order to allow communities to deconsecrate and/or protect them. In addition, two (2) cemeteries by-passed by the line will also receive compensation, in particular to allow them to install protective wire-mesh fencing. In Niger, consultations with the municipal and regional authorities revealed the existence of several cultural heritage-related sites in the project area. Only one tomb was identified in Niger close to a residence to be displaced. **In Nigeria and in Benin**, consultation with the local and authorities did not identify any cultural heritage-related site or resource in the project area.

### 6.1.2 Operational Phase

#### 6.1.2.1 Biophysical Environment

- **Impacts on Water and Soils**: During the operational phase potential oil leaks from machinery and/or accidental spillage of hazardous materials may alter the chemical parameters which could possibly lead to its contamination and that of the soil.

- **Impact on Flora**: during the operational phase, maintenance of the right-of-way and infrastructure will require regular maintenance of vegetation in order to mitigate the risk of a short circuit caused by an electrical arc. This means that no vegetation will be authorized to grow within 4 km of the right-of-way. Right-of-way maintenance will result in the continuous alteration of existing habitats. The most affected forms will be woody species including trees and shrubs. Periodic disruptions will mean that the line habitats will be maintained in young stages of plant development resulting in the presence of the most common species and the scarcity of woody species. Right-of-way maintenance will thus help to maintain disturbed habitats all along its length. This long-term modification of natural habitats could create a certain barrier effect for small wildlife limiting its movements or exposing it to predators. On the other hand, the existence of the access road in previously inaccessible areas could lead to an increase in the exploitation of natural resources and a reduction in communities of species with a higher utility value. Such activities are particularly worrisome on currently less accessible protected areas such as the Dosso Partial Reserve in Niger.

- **Impact on Avian Fauna**: The characteristics of the power line’s host environment and its location may greatly influence the probability of collision. Power line collision rates may vary over time (depending on the season, migratory birds in the area increase the risk of collision, hazy weather conditions may limit the line’s visibility, especially in aquatic areas, etc.) and in space depending on the area in which it is located and its characteristics. In addition, the different species are relatively vulnerable to collisions. Several factors may influence collision such as, flight in flocks, rapid flight, wide wing spans, nocturnal migrations and species with poor vision (cranes and water birds). Water birds are recognized as being most prone to colliding with power lines. The risk of collision is higher for species with reduced binocular vision with wide blind spots. Visual fields which have mainly evolved to meet feeding requirements, may make some species particularly vulnerable to collision.
6.1.2.2 Human Environment

- **Impact on the Quality of Life, Health and Safety**: The presence of power lines represents a potential safety risk for local residents where people sometimes try to make illegal connections. The theft of steel from pylons may also raise major safety risks in the event of the tower collapsing. Health problems as well as exposure to the electromagnetic field are often cited when a new transmission line is proposed. Based on a recent comprehensive review of scientific literature, WHO concluded that, despite in-depth research, there is no evidence to-date to reach the conclusion that exposure to low-intensity electromagnetic fields is harmful to human health. A negative impact may, however, be felt by local communities near the line or sub-stations and households with fields under the line in terms of nuisances especially from continuous noise that could intensify during the rainy season.

- **Social Cohesion and Gender Relations**: while the impacts on communities and social cohesion are likely to be mainly felt during the construction phase they may also be felt during the operational phase to a lesser extent because of the presence of workers for maintenance activities. Local employment should be prioritized. The loss of crops (annual and perennial) due to maintenance activities may affect women more than men. Indeed, women are usually in charge of subsistence activities and struggle to supply their household when crops are limited.

- **Landscape**: The overall aesthetic impact of a transmission line may be negative for some people, especially where the proposed lines cross natural habitats. The high steel structure may appear out of proportion and incompatible with agricultural landscapes, vast plains or lush hills. Research and experience show that the reactions to transmission line aesthetics vary. Some residents do not notice them or find them aesthetically unacceptable. Others consider that transmission lines or other public services are part of the necessary infrastructure to support everyday life and are, therefore, acceptable.

6.4 Impacts in the Decommissioning Phase

It should be noted that the impacts stemming from the project decommissioning and rehabilitation phase have not been identified or assessed in the ESIA reports. Indeed, it is expected that the power line and associated sub-stations will be continuously maintained and operated for several decades. It was recommended that a full assessment of the impacts of the decommissioning and rehabilitation phase be carried out when sufficient information on related activities and detailed implementation are made available.

6.5 Cumulative Impacts

Cumulative Impacts are the result of the supplementary or synergistic impact of different past, current or planned projects. Assessment of the impacts of the North-Core Project, presented in the previous sections, focused on identifying the impact of this single project on the different EIS in the study area. The assessment of cumulative impacts identifies the projects or other activities located in the project region on and which may have an impact on the different EIS assessed. The projects or activities likely to generate cumulative impacts with the North-Core Project are as follows

6.5.1 Physical Environment

Different cumulative impacts could felt on the physical environment of EIS in the study area. These impacts are mainly negative:

(i) Transport activities, machinery and generators will generate GHG and various atmospheric emissions that could reduce air quality. Moreover, the constant land conversions lead to changes in air quality caused by wind erosion and also by the emission of carbon which was previously buried in the ground or captured by vegetation.
(ii) The different construction activities, including transportation activities, could generate noise. This impact will be amplified if the sources of noise are active over simultaneous period in specific places. The scale of the cumulative impact will depend on the source of the noise created;

(iii) Spillage of hazardous materials onto the ground or in water could modify the physico-chemical properties of soil and water, which will later create environmental contamination. These risks are even higher in the event of poor hazardous material management;

(iv) Changes to soil occupancy, excavations and backfill works and the construction of different types of infrastructure will modify soil profiles and could transform drainage and erosion patterns. These impacts could be amplified in areas where infrastructure is most concentrated i.e. along linear infrastructure.

6.5.2 Biological Environment

The main cumulative negative impacts on the biological environment from identified projects are as follows:

(i) The different developments and urban expansion will lead to a reduction in the area of natural habitats. These losses could be greater along the new transport routes created. The reduction of the area of natural habitats and their connectivity lead to the disappearance of the most specialized species. These impacts will be particularly harmful in areas of high biodiversity like the one identified among the key habitats.

(ii) The potential transformation of physico-chemical parameters of the environment (air, soil and water) will lead to the degradation of existing natural environments. These changes will influence the composition of plant and animal communities with the potential proliferation of the most resistant species. The most sensitive or vulnerable species such as those with a specific status will be the worst affected. Contamination phenomena could evolve through the food chain.

(iii) The different linear structures proposed could lead to the modification of flow patterns on a territorial scale and could result in the loss or modification of different types of riparian, humid and marshy habitats as well as a significant reduction in the related wildlife populations.

6.5.3 Social Environment

The main cumulative negative impacts on the social environment resulting from identified projects are as follows:

(i) Anthropization of the area will impact on the transformation of existing land use. The construction of linear infrastructure will contribute locally to the densification of human occupancy and the transformation of usual land use activities. Areas allocated to natural habitats could, therefore, decline in favour of anthropized areas;

(ii) The impacts of the loss, disruption and fragmentation of habitats will limit the ecosystem services that local communities currently enjoy;

(iii) Several projects affect electrification and improvement of means of transport, which are both likely to foster economic development. Rapid economic development will accelerate changes in the existing population’s lifestyles. Wide disparities were observed that could further widen in the absence of wealth distribution and social mobility improvement measures. These persistent inequalities could result in a high vulnerability to poverty for part of the population and to conflicts; and
The supply of urban centres with electricity and the establishment of rail networks enhance the attractiveness of urban centres which are more closely connected to the detriment of rural centres. This phenomenon increases urban density and land use conflicts, especially in urban areas, where the urban fabric could replace areas dedicated to agricultural activities.

6.6 Positive Impacts in the Construction and Operational Phases

The main project outcomes concerning the supply of electricity to the productive sectors of the economies of the countries concerned; reduction in the cost price per kWh in Niger, Burkina, and in Benin/Togo; facilitation of access to electricity; expansion of the power pool system and creation of a regional electric power market. Power transit forecasts on project completion in 2020 are 300 MW, which will rise to 666 MW in 2025 and 915 MW in 2035. The rural electrification component will concern a population of 540,000 people spread over 294 rural communities and 68,000 households in Nigeria, Niger, Benin/Togo and Burkina Faso.

Project implementation will have a significant impact on sub-regional economic activity through contracts that will be won by local enterprises (public works, transport, buildings, consulting firms, etc.). The project will lead to the creation of a large number of jobs during the construction phase but also in the medium to long-term with the exploitation of infrastructure and the generation of many opportunities in related sectors such as telecommunications, agriculture, fisheries, tourism and transport. The project will create 250 permanent jobs of which 25% will be for women. There will also be 600 temporary jobs of which 17% will be for women.

The project will also contribute to the opening up of its area of interest and the development of income-generating activities, in particular for women and young people (catering, petty trading and handicrafts).

In terms of mitigation, the project will contribute to the avoidance of greenhouse gas emissions representing 243,090 toe of CO2 per year. This estimate was made on the basis of energy to be injected from Nigeria (based on water and natural gas). Replanting of trees to restore the ecosystem will enhance this positive project impact.

During the works phase that will comprise an area of about two hundred kilometres for the west region, the works will require considerable labour to be recruited among the region’s youth. After the project phase, the availability of electric power will contribute to the development of electrified communities, mainly informal and based on handicrafts and petty trading sectors of activity in which women and young people are the main actors. The supply of electricity will provide these activities with many development opportunities by ensuring, in particular, the preservation of fresh foodstuffs, the chilling of drinks, the use of small machine tools for woodworking, the opening of internet cafes etc., etc... Lastly, in connection with public lighting, the supply of domestic electricity in the localities concerned will improve the security of the population.

6.7 Mitigation/Enhancement and Monitoring Measures Anticipated at this Stage

6.7.1 Normative and Administrative Measures

It will be necessary to ensure project compliance with applicable regulations and administrative requirements in particular:

- **Compliance with Environmental and Social Regulations**: the project will ensure compliance with existing environmental regulations in force in the countries concerned and those of the AfDB during implementation. In this respect, the ESIA, ESMP and RAP have been validated by the Ministry responsible for the Environment in Benin, Niger and Nigeria. In the case of Burkina Faso, the reports have been submitted and are being validated.

- **Compliance with Land Regulation**: Since the project requires expropriation, the resettlement plan prepared must be compliant with land regulations in force in the countries concerned. These elements are contained in the RAPs prepared as separate documents.
• **Selection and Recruitment of Contractors**: the environmental and social clauses will be included in the bidding documents (BD). The environmental component of the site’s internal rules will also be drafted to mainstream environmental considerations into the contractor’s practices and the behaviour of its employees. An environmental expert shall be recruited by the contractor. In addition, bidders shall present upon bid submission, the final detailed environmental and social management programme, including the Environmental Protection Plan (EPP) and Site Hygiene, Health and Safety Plan (HHSP) or the FESMP in compliance with OHSAS international standards 18001: 2007, which draws mainly on the measures recommended in the North-Core Project ESMP. The FESDMP will be submitted within 60 days of notification. Its minimum content is indicated in the ESIA reports.

• **Fair, Equitable and Prior Compensation** of project-affected people for assets identified in the RAP. The budget including all the measures agreed upon under this plan together with implementation and monitoring and evaluation costs of the operation amounts to: (i) CFAF 33,743,850, i.e. USD 56,240 for Benin; (ii) CFAF 2,774,536, 751 i.e. USD 4,624,228 for Burkina Faso; (iii) CFAF 1,021,615,298, i.e. USD 1,702,692 for Niger; and (iv) 1 259 670 712 Naira i.e. USD 6,323,966 for Nigeria. For further details on the cost and financing plan, please refer to the resettlement plan. It should be noted that these costs are provisional.

### 6.7.2 Construction Phase

#### 6.7.2.1 Biophysical Environment

- **Air Quality Protection Plan**: Shield the piles of fine excavated materials with anti-erosion covers especially during periods of strong winds. Also cover loads of materials during transportation. Prepare and establish a Residual Materials Management Plan which strictly complies with sound waste management practices including a ban on the burning of solid waste.

- **Risks of Water and Soil Pollution**: Keep spill response kits accessible on the site in the event of accidental spillage and ensure that personnel are trained to use it. Prepare and implement an Emergency Measures Plan.

**Biodiversity Action Plan**

The plan’s objective is to ensure that the biodiversity challenges are fully integrated into the project’s implementation. While measures have been implemented or are planned to avoid impacts, negative impacts are anticipated for components with a high biodiversity value such as key habitats and threatened and protected species. The biodiversity action plan therefore aims to propose management measures that will ensure that there is no net loss but a net gain of biodiversity throughout the project life cycle. Avoidance measures were discussed in the impact analysis. The different biodiversity action plans will more fully discuss impact mitigation and compensation strategies while considering the proposed specific monitoring measures and studies.

**Giraffe Protection in Niger**

In order to contribute to a net biodiversity gain concerning key giraffe habitats in Niger, all losses of habitat in bottomlands, striped bush, riparian strips and even in agricultural areas must be compensated since it is expected that woody vegetation will be cut. It is anticipated that a total of 274,433 trees will have to be replanted in order to offset the impacts. It is recommended to rehabilitate currently degraded areas. It should be mentioned that, since the giraffe distribution area overlaps most of the key habitats identified, the giraffe plays the role of an umbrella species. Niger’s giraffe distribution area overlaps the large majority of Bosso and Maouri Dallol sites as well as the Dosso Partial Reserve. Compensation for losses of this habitat will, therefore, offset losses in other key habitats: (i) reforestation; (ii) identification and maintenance of natural regeneration.
Other activities are planned as part of this specific plan, in particular: (i) a contribution to the giraffe management plan; (ii) improvement of resource exploitation systems; (iii) reduction of human/giraffe conflicts relating to agricultural practices; and (iv) monitoring.

**Protection of the Bosso Dallol RAMSAR Site**

Management measures to protect the physical and biological components will contribute to impact mitigation in the Bosso Dallol. In addition to these measures, specific measures have been identified and summarized as follows:

In the construction phase:

- Compensate for any loss of reproduction and nesting sites by creating appropriate habitats elsewhere, in particular by rehabilitating degraded habitats;
- Place anti-collision devices or deflectors on the earthing cable to make the lines more visible for birds if there is a high risk of collision especially within or close to ecologically sensitive areas (humid environments, ponds, migratory halts, bird migratory corridors and water courses) in accordance with the following requirements (i) installation on earthing cables in a staggered pattern; (ii) Installation only in the middle 60% below the line’s span; (iii) installation at 10m intervals on each earthing cable;
- Carry out the cutting of trees and/or shrubs before or after the nesting periods of species with identified status;
- Adjust the location of pylons so that they straddle the wetlands. During the works restrict as much as possible access of equipment in these wetlands;
- Carry out vegetation cutting and pruning work with the assistance of a botanist in key habitats. Point out the presence of any threatened species and offset losses as required;
- No access road should be constructed in a key habitat. Any creation of access necessary for emergency reasons will have to be rehabilitated;
- Conduct a detailed inventory of avian fauna on the RAMSAR and Makalondi District IBA sites to study the existing communities of birds and habitats used by avian fauna;
- In the operational phase, in view of the proximity of the line’s right-of-way to existing infrastructure, the anticipated impacts particularly concern avian fauna;
- Provide for right-of-way maintenance activities that will avoid reproduction and nesting seasons of species of birds with special status. Stop maintenance activities if active nests are found in the right-of-way during maintenance.

Other measures include: (i) compensation for loss of habitats and rehabilitation of degraded areas; (ii) preparation of the Bosso Dallol RAMSAR Site Management Plan; and (iii) complementary studies and monitoring.

**Protection of Maouri Dallol**

The management measures aimed at protecting the physical and biological components and will help to mitigate the impacts at the level of Bosso Dallol are the same as those of the Bosso Dallol during the construction phase.
Other measures include: (i) compensation for the loss of habitat and rehabilitation of degraded areas; (ii) contribution to development of the Maouri Dallol site management plan; and (iii) complementary studies and monitoring.

Protection of the Makalondi District IBA

The management measures to protect the physical and biological components will contribute to impact mitigation in the Makalondi District IBA. In addition to these measures, specific measures have been identified.

In the construction phase:

- Compensate for any loss of reproduction and nesting sites by creating appropriate habitats elsewhere, in particular by rehabilitating degraded habitats;
- Place anti-collision devices or deflectors on the earthing cable to make the lines more visible for birds if there is a high risk of collision especially within or close to ecologically sensitive areas (humid environments, ponds, migratory halts, bird migratory corridors and water courses) in accordance with the following requirements (i) installation on earthing cables in a staggered pattern; (ii) installation only in the middle 60% below the line’s span; (iii) installation at 10m intervals on each earthing cable;
- Carry out the cutting of trees and/or shrubs before or after the nesting periods of species with identified status;
- Adjust the location of pylons so that they straddle the wetlands. During the works restrict as much as possible access of equipment in these wetlands. Carry out vegetation cutting and pruning work with the assistance of a botanist in key habitats. Report the presence of any threatened species and offset losses as required;
- No access road should be constructed in a critical habitat. Any creation of access necessary for emergency reasons will have to be rehabilitated;
- Strengthen monitoring of natural resources and poaching in the Niger Giraffe Distribution Area, the Makalondi IBA District and the Dosso Partial Reserve;
- Conduct a detailed inventory of avian fauna on the RAMSAR and Makalondi District IBA sites to study the existing communities of birds and habitats used by avian fauna;
- Involve the rural municipalities of Djandjandiori and Panoma in planning the cutting of vegetation within the village forests. Ideally, no cutting should be carried out between May and October; and
- Ensure that the felling carried out in the Djandjandiori and Panoma forests optimize combretaceae stump shoots;

In the operational phase, in view of the proximity of the right-of-way of the line to existing infrastructure, the anticipated impacts particularly concern avian fauna.

- Involve the rural municipalities of Djandjandiori and Panoma in planning the cutting of vegetation within the village forests. Ideally, no cutting should be carried out between May and October;
- Ensure that the felling carried out in the Djandjandiori and Panoma forests optimize combretaceae stump shoots;
• Provide for right-of-way maintenance activities that will avoid reproduction and nesting seasons of species of birds with special status. Stop maintenance activities if active nests are found in the right-of-way during maintenance;

• Carry out strict monitoring of degradation of the Djandjandiori and Panoma village forests and the Dosso Partial Reserve; and

• Increase the resources of forest officers to ensure more effective monitoring of the Djandjandiori and Panoma village forests and the Dosso Partial Reserve.

Other measures include: (i) compensation for the loss of habitat and rehabilitation of degraded areas; (ii) the protection of vitellaria paradoxa; (iii) maintenance of natural generation; (iv) contribution to development of the Makalondi District IBA management plan; and (iii) complementary studies and monitoring.

Protection of the adjacent Dosso Partial Reserve

Management measures to protect the physical and biological components will contribute to impact mitigation in the Bosso Dallol. In addition to these measures, specific measures have been identified and summarized as follows:

In the construction phase:

• Compensate for any loss of reproduction and nesting sites by creating appropriate habitats elsewhere, in particular by rehabilitating degraded habitats;

• Place anti-collision devices or deflection devices on the earthing cable to make the lines more visible for birds if there is a high risk of collision especially within or close to ecologically sensitive areas (humid environments, ponds, migratory halts, bird migratory corridors and water courses) in accordance with the following requirements (i) installation on earthing cables in a staggered pattern; (ii) installation only in the middle 60% below the line’s span; (iii) installation at 10m intervals on each earthing cable;

• Carry out the cutting of trees and/or shrubs before or after the nesting periods of species with identified status;

• Adjust the location of pylons so that they straddle the wetlands. During the works restrict as much as possible access of equipment in these wetlands;

• Carry out vegetation cutting and pruning work with the assistance of a botanist in critical habitats. Point out the presence of any threatened species and offset losses as required;

• No access road should be constructed in a key habitat. Any creation of access necessary for emergency reasons will have to be rehabilitated;

• Carry out a one week vigil in the Dosso Partial Reserve prior to works commencement in order to identify the presence of large animals in the project area. If large mammals are present in the area, wait until no large animals have been seen in the project area for one week before carrying out vegetation cutting work;

• Monitor the movement of large animals in the Dosso through the works period in order to avoid their presence in the construction areas. Stop the works and clear the materials if their presence is reported;

• Carry out a targeted inventory of the Egyptian vulture (Neophron percnopterus) within the Dosso Reserve in order to analyse the use by species of habitats in the project right-of-way and locate nesting sites. Compensate for any loss of habitat with a view to achieving a positive impact on the species; and
Strengthen monitoring of natural resources and poaching in the Niger Giraffe Distribution Area, the Makalondi IBA District and the Dosso Partial Reserve.

In the operational phase, in view of the proximity of the right-of-way of the line to existing infrastructure, the anticipated impacts particularly concern avian fauna:

- Provide for right-of-way maintenance activities that will avoid reproduction and nesting seasons of species of birds with special status. Stop maintenance activities if active nests are found in the right-of-way during maintenance;
- Install artificial perches that are adapted to the Egyptian vulture in the Dosso Partial Reserve.

Other measures include: (i) compensation for the loss of habitat and rehabilitation of degraded areas; (ii) planning the reserve’s conservation activities; (iii) protection of the Egyptian vulture and (iv) complementary studies and monitoring.

Vegetation Management Plan

Vegetation management requires interventions within the right-of-way and also concerning vegetation outside the right-of-way but which might pose a risk for the line.

Sound vegetation management within the right-of-way will: (i) facilitate access to the line by emergency teams if it breaks; and, (ii) in the event of fire, act as a barrier to its spread and limit the fire’s impact on the line.

Strict vegetation control should also be carried out periodically during the operational phase to ensure that woody species do not present a risk for the power line. Several factors will influence the nature of these vegetation management activities:

- Sensitive components which are in the proximity of the line or which are crossed by the line in certain places;
- The existing types of plant communities, especially their density and their height at maturity as well as their growth rates; and
- Accessibility and intervention costs.

Vegetation maintenance will be very important in some locations in view of the ecological role it plays. The line’s security is the main priority. However, specific vegetation management studies must be proposed:

- In erosion-prone areas, vegetation which is compatible with the line and recognized for its soil retention capacity should be established; in areas close to the line, vegetation should be maintained in order to limit suspended particles, reduce evaporation and water temperatures and to provide wildlife habitats;
- In areas with higher ecological potential, fire-resistant shrubby species should be planted in order to supply wildlife habitats and thereby mitigate the fragmentation and edge effects that might be caused by the power line.

Other measures include: (i) the management of invasive exotic species; and (ii) communication.

Residual Materials Management Plan

The construction and operation of the power lines and sub-stations generate significant quantities of residual materials which may be non-hazardous or hazardous. The nature of this waste varies according to the project phase. In the
construction phase, residual materials mainly comprise: (i) packaging materials (wood, boxes, plastic); (ii) organic materials (plant and food residues); (iii) used oil and hydrocarbons from machinery maintenance.

In the operational phase, maintenance of equipment and the replacement of some components could generate a significant quantity of residual materials such as:

- porcelain, glass and metal from old transformers and electrical insulator; and
- used oil.

**Archaeological and Cultural Heritage Management Plan**

The objective of the Archaeological and Cultural Heritage Management Plan (ACHMP) is to propose clear and realistic management measures aimed at conserving the physical cultural heritage linked to archaeological and burial sites as well as its protection against the negative impacts from the construction, operation or any other aspect of the project. More specifically, the ACHMP aims to: (i) significantly alleviate the population’s discontent concerning the loss of tangible cultural elements; (ii) collaboration with government authorities responsible for the management of national physical cultural heritage through archaeologists using current mapping research and conservation methods; (iii) avoid possible delays in project implementation by becoming more involved with national institutions and by complying with national laws and international best practices. The goals of this management plan is to clearly define the general properties and importance of burial and archaeological sites located in the project right-of-way, identify and justify the specific stages which must be completed in order to protect them.

Accidental Discovery Procedure: the aim of the fortuitous discovery procedure is to identify heritage sites, objects and items not yet inventoried and to protect them from possible damage caused by the project. The procedure applies to objects, items or sites which are potentially part of the cultural heritage, identified during vegetation clearance from the soil’s surface or other related activities. It complements the other previously described mitigation measures regarding items not discovered during the pre-construction assessments. A key aspect of the accidental discovery procedure consists in the presence of an archaeologist mandated to carry out field monitoring of activities that disturb the soil.

**Stakeholder Engagement Plan**

**Communication Activities during the Pre-Construction/Construction Phase**

Throughout the activities to prepare the land, clear the right-of-way and throughout the construction work, the affected communities and other stakeholders will be informed on the status of the planned works and their timelines.

**Communication Activities during the Operational Phase**: During the project operational phase, the following information will be provided to the communities and other stakeholders in an accessible format and language: (i) the project environmental and social monitoring results; (ii) planning of maintenance work on the right-of-way and equipment; (iii) instructions concerning restrictions on the use of the right-of-way; (iv) public safety hazards associated with the presence of the power line and dangerous behaviour to be prohibited.

The main project administrator of the North-Core Project Unit will be responsible for all of the stakeholder engagement process. The manager in charge of the environment in the project team will assume responsibility for the main duties relating to the project while retaining overall responsibility for the engagement programme and its success.

**Emergency Response Plan**

The objective, in terms of risk management, consists in mitigating, to a reasonable extent, risks to the lowest levels. An accident could, however, affect people on the site, property and the environment. Therefore, it is important to identify risks so that resources are provided to be able to intervene promptly and reliably in the event of a major accident.
These plans will also be periodically reviewed and adapted throughout the project’s implementation. Therefore, the development and application of these plans will vary in accordance with the project plans and phases.

6.7.2.2 Human Environment

- **Compensation**: Monitoring of the RAPs and functioning of Conciliation Committees. Since the submission of evidence of justifications is a condition precedent to works commencement on the sections concerned, it is important to ensure optimal RAP implementation.

- **Noise and Nuisances**: In order to mitigate the effect of this impact, it will be necessary to (i) avoid night work; (ii) ensure that the machinery meets sound insulation standards; position workshops and living quarters at standard distances from dwellings and schools and provide employees with adapted IPE.

- **Health and Safety of Workers and Local Communities**: The contractor shall also prepare and implement a Health, Hygiene and Safety (HHS) Plan in compliance with international standards, OHSAS 18001:2007. The engineer will supervise the Plan’s preparation and implementation.

6.5.3 Operational Phase

- **Habitat Loss and Fragmentation**: Strengthen monitoring of natural resources and poaching in the Niger Giraffe Distribution Area, the Makalondi District IBA and the Dosso Partial Reserve as well as the Gonse forest. Conduct a detailed inventory of avian fauna on sensitive sites. Involve the rural municipalities in planning vegetation clearance within the village forests. Ideally, no clearance should be carried out between May and October. Implement the biodiversity activity plan.

- **Risk of Collision (Fatalities or Injuries) for Avian Fauna**: Place anti-collision devices or deflectors on the earthing cable to make the lines more visible for birds at the Bosso and Maouri Dallol RAMSAR Sites as well as the Makalondi District IBA and the Dosso Partial Reserve in accordance with the following requirements: installation on earthing cables in a staggered pattern; installation only in the middle - 60% below the line’s span; installation at 10m intervals on each earthing cable.

- **Quality of life, health and safety**: Protect residences and other permanent structures (schools, warehouses or offices) outside the route in order to minimize exposure to EMF and to noise. Sensitize the local population on safety behaviour in the presence of a high voltage line by implementing the Capacity Building Plan. Sensitize localities in the vicinity on the dangers of illegal connections, theft of steel and all other forms of contact. Install warning signs and anti-climb devices near the pylons. Ensure the development of local and regional PMU in case of local infrastructure, especially close to roads or industrial zones.

- **Economic Disturbances**: Ensure adequate and prompt compensation for harvest losses relating to maintenance activities. Take gender considerations into account in their payment while considering corps that are specific to women.

**Additional Initiatives**: The rural electrification component will concern a population of 540,000 people spread over 294 rural communities and 68,000 households in Nigeria, Niger, Benin/Togo and Burkina Faso. This rural electrification component will also contribute to the electrification of schools, health centres, administrative buildings, etc.
Concerning the resettlement component, see the RAP summary.

7. RESIDUAL IMPACTS AND ENVIRONMENTAL RISK MANAGEMENT

7.1 Negative Residual Impacts

No residual impact of great significance is expected following implementation of mitigation measures. The negative residual impacts are minor and are not the subject of specific measures.

7.2 Environmental Risk

The operation of a power line or electricity sub-station entails some environmental risks. These risks may be of natural or technological origin. Generally, natural risks are those caused by natural phenomena such as rainfall, floods, tornados, drought, bush fires, etc. Natural risks may be a source of technological dangers or risks.

Technological risks depend on the identification of dangers (hazardous products, system failures, sources of breakage and usual project risks, etc.). Natural risks concerning this project are mainly linked to lightning which could short-circuit a network, erosion phenomena, especially at the level of food-prone areas and/or bush fires which could occur close to the lines or sub-stations. These risks are, however, managed at the technical level by the incorporation of specific components at the project design stage (earthing cable, careful selection of pylon sites, composition of foundations, adequate clearance area, etc.). The risk analysis focuses in particular on the technological risks relating to the North-Core Project power line and sub-stations.

The main risks arise from: (i) the storage and use of petroleum products; (ii) the presence of PCBs and asbestos; (iii) the presence of power transmission infrastructure; and (iv) the use of electrical transformers.

An appropriate emergency response plan will be formally prepared on the basis of the progress of each project phase in order to act diligently, confidently and rapidly in the event of disaster. The contractor responsible for the construction phase, will, in particular, be responsible for developing an emergency response plan in order to manage the risks he/she will have identified relating to the planned activities. The emergency response plan will also be reviewed periodically and adapted for each of the construction and operational phases. It will target the different activities of each phase and the related risks. Any event that could threaten or affect the environmental components will trigger the emergency response plan. This will ensure that actions are taken to adequately respond to emergency situations arising from the identified risks. The following section describes the main elements to be retained and integrated into the emergency response plan which will be prepared to intervene rapidly and effectively during the different project phases. The Emergency Response Plan has the following three objectives: (i) clearly establish the role and responsibilities of the actors during both the construction and operational phases; (ii) facilitate the plan’s communication to the people concerned such as employees and the population; (iii) serve as a reference document during alert, mobilization and response procedures.

All pylons are equipped with a protective barrier 3 to 6 metres above ground to prevent climbing without special equipment. This protective barrier made of barbed wire mesh has a bolted door at the corner of the pylon supporting the access ladders. The cable attachment point should be 25.0m above ground. All the pylons have an identification plate. It is attached by anti-vandal bolts on a support located above the anti-climb device. All 20 pylons have a tower identification plate to allow them to be located by helicopter. These are attached to the upper part of the pylon.

The other measures concern: sensitization and training of construction officers and ad hoc teams in rapid response techniques in the event of disasters, safety measures to be complied with in dangerous or risky areas, the sensitization of local communities as regards risk prevention and safety. All these measures will be set out in detail in documents to be submitted by the contractor and approved by the control office prior to works commencement: (i) the waste management plan; (ii) all the site protection measures and implementation schedule; (vii) methods for preventing and reducing pollution, fires, etc.; (viii) health facilities and access by the population in the event of emergencies; (ix) site regulations on environmental protection and safety.
An Emergency Response Planning Committee will be active in each electricity company which will maintain its emergency response plan updated in order to efficiently mobilize resources in the event of an emergency. The different elements of the plans will be periodically revised by the Emergency Response Planning Committee. Its role will be to draft, prepare, update and disseminate the emergency response plan, initiate and prepare large-scale simulations, revise results and monitor them, train employees and management by holding simulations or evacuation exercises; develop response relationships with civil authorities; initiate the annual review process of the emergency response plan and update operational plans.

The internal emergency response team will include personnel on-site representing a front line emergency response team in the communication and deployment system in the event of an emergency. This team’s role will be to answer and duly prioritize emergency calls. It will immediately communicate the information to management, the appropriate emergency services and, should the situation require, obtain assistance from external sources.

**8. SUPERVISION/MONITORING PROGRAMME AND INSTITUTIONAL RESPONSIBILITIES**

**8.1 Supervision**

**8.1.1 Supervision Objectives and Content**

The aim of environmental supervisions is to ensure the effective implementation of environmental measures. Its main objectives are to: (i) ensure compliance with laws, regulations and strategies in force in the government services concerned; (ii) respond to government directives concerning the guidelines set out in the Environmental and Social Impact Assessment; (iii) present an environmental assessment in the event of the appearance of impacts not predicted in the ESIA and propose adequate solutions; (iv) enable the developer to respond promptly to the failure of any planned mitigation measure or any other unexpected disruption to the environment; and (v) apply sanctions and penalties as laid down in the different contracts between the developer and third parties.

In order to ensure effective project monitoring the stages to be followed are: (i) prepare the supervision programme; (ii) define the operations to be controlled; (iii) identify and locate the sites to be supervised; (iv) conduct an inventory and understand the environmental measures proposed in the ESIA report.

**8.1.2 Operations Requiring Supervision**

Overall, the operations requiring environmental monitoring comprise:

- Compliance with site environmental and social regulations;
- Soil integrity;
- Hydrology and water quality;
- Air quality and noise levels;
- State of vegetation;
- Wildlife protection and conservation;
- Nuisances to local communities;
- Site health and safety measures;
- Local and regional economy.
8.1.3 **Supervision Actors**

**Contractor’s HSE Officer**: in a company, internal control is carried out by an environmental and social team. The HSE officer will be responsible for the implementation of certain measures but will remain the main environmental supervision actor.

**Control Mission HSE Officer**: The control mission environmental officers will be the main environmental supervision agents. Their role will be to ensure effective implementations of environmental measures. In order to be successful they will have to work closely with their counterparts employed by the works contractors.

**Local Communities**: The role of the local communities in environmental supervision is to ensure that the planned environmental and social measures are correctly implemented. In order to ensure that the project activities do not degrade their living environment, local residents should take part in environmental supervision. To that end, they should be aware of their rights and duties and all the environmental guidelines to be complied with to avoid unfounded claims that could be sources of conflict. To the extent possible they must report any shortcomings concerning planned measures which are not correctly implemented.

8.2 **Monitoring**

8.2.1 **Objectives**

Performance monitoring comprises three aspects: (i) Monitoring of the implementation of management measures and specific management plans recommended during the construction phase; (ii) Monitoring of selected environmental and social indicators linked to the sources of anticipated impacts and changes in the environmental and social parameters induced by the project during the operational phase; (iii) Audits to assess the ESMP strengths and weaknesses.

8.2.2 **Monitoring Actors**

The electricity companies, which are the project owners, are responsible for implementation of the project, ESMP and RAP. In the case of the RAP, they are also responsible for its financing. The environmental specialist as well as a resettlement specialist in each company operating in the North-Core Project Unit are responsible for environmental supervision and monitoring. In particular, these experts are responsible for the enforcement of environmental provisions, contacts and negotiations with the government services concerned, the organization of surveys and public consultations concerning the project.

The heads of ESMP monitoring and implementation bodies in the countries concerned are responsible for preparation work for the approval of the project ESIA, ESMP and RAP. They then carry out adequate external control of the implementation of management measures (reduction, mitigation, enhancement and compensation), including resettlement aspects. They may also mobilize local representatives of the government responsible for environmental and resettlement issues in order to support it in its interventions. These are: (i) the Benin Environmental Agency (ABE); (ii) The National Environmental Assessment Bureaus (BUNEE) of Burkina Faso; (iii) Environmental Assessment and Impact Studies Bureau (BEEEI) of Niger, and (iv) National Environmental Standards and Regulations Enforcement Agency (NESREA) for Nigeria.

The Forestry Departments in these countries are responsible for managing trees with 20cm diameters and up to chest level which have to be removed from the right-of-way. They will, therefore, be involved when they are compensated in order to comply with the applicable guidelines.

The Conciliation Commission participates in the RAP’s implementation, particularly regarding the resolution of grievances and is the guarantor of effective distribution of compensation. However, pursuant to an Order of the Governor of the region concerned and at the proposal of the structures concerned, the members of the Commission are: an official from the State Lands service, the mayor or mayors or their representatives when the contested land is located in one or more municipalities, one or two MPs from the region designated by the President of the Appeals Court, one
judicial officer to be designated by the President of the Appeals Court, Urban Planning representative, one Housing division representative, Chiefs of cantons or groupings or their representatives and a representative of the Land Commission.

**Project Executing Agencies:** As designed, the Project Executing Agency will be the WAPP general secretariat, and a project management unit (PMU) currently being established in it will perform assume project supervision and management responsibilities during the investment phase. The composition and of the PMU and profiles of its members will be specified and set out in detail during project appraisal. A Project Steering Committee (PSC) will be established comprising the CEOs of national electricity companies or their delegates as well as the WAPP Secretary-General. They will be responsible for the supervision and monitoring of the PMU’s work and will approve its annual work programme and budget and contracts. A Ministerial Project Monitoring Committee (MPMC) will also be established comprising the Ministers of Energy of the countries participating in the project. This Committee will provide guidance on strategic and policy issues and take decisions on issues raised by the PSC which require intergovernmental solutions.

### 8.3 Environmental and Social Issues

The role of internal audits is to assess activities in relation to procedures, measures and plans contained in the ESMP in order to ensure compliance with environmental and social commitments and objectives. Each element of the management system is audited at least annually for the first five years, then at five-year intervals. Non-compliance reports will be retained in a database accompanied by preventive or corrective measures as well as the official, timeframe and necessary resources to apply the recommended measures. As in the case of internal audits, the role of external audits is to assess the activities in relation to the procedures, measures and plans provided for in the ESMP in order to ensure compliance with environmental and social commitments. However, an external audit provides a different perspective coming from an accredited auditor who will ensure that the activities are compliant with specific requirements that the environmental and social objectives will be reached and that the overall approach is effective.

Quarterly environmental and social supervision reports should be prepared by the environmental officers of the control mission. These reports, which summarize their activities and the difficulties encountered, will be submitted to AfDB.

### 9. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

#### 9.1 National Requirements

**Benin**

The reference texts governing the stakeholder consultation procedure are: (i) Law No. 2013 – 01 of 14 August 2013 establishing the Private and State-owned Land Code of the Republic of Benin and its implementing decrees; (ii) the Framework Law on the Environment (Act 98-030 of 12 February 1999) and its implementing decrees. Article 96 of the Framework Law on the Environment stipulates that ‘the public hearing on the environment is a consultation of the population on environment-related issues. It ensures that citizens have access to information and allows them to ask the necessary questions on the subject of projects, or to express their opinions.’ These two procedures show that: (i) the State of Benin is eager to prevent damage caused to people (ii) alleviate or compensate such damage and (iii) have the population participate in decision-making relating to the environment.

**Burkina Faso**

National requirements concerning information and stakeholder participation in EISAs in Burkina Faso are contained in Decree 2015-1187 laying down the conditions and procedures for the implementation and validation of the strategic environmental assessment, the environmental and social impact study and notice. In Chapter III of this Decree on the procedure for carrying out ESIAs, there is stress on the need to consult stakeholders during the scoping phase of the study. Its development and the validation of the final results. In this regard, Article 12 stipulates that at this stage, the developer, ‘shall inform by any appropriate means, the local administrative authority and the population on the envisaged project site of the conduct of the Environmental and Social Impact Assessment’. Article 13 stipulates that the
Terms of Reference submitted following the scoping must present the conditions for public participation envisaged for the development of the ESIA

**Niger**

Decree 2000-397/PRN/ME/LCD of 20 October 2000 governing the administrative procedure for the assessment and review of environmental impacts of which Article 10 defines the ESIA advertising mechanism in the following 4 stages: (i) inform the population of the conduct of the studies for the possible preparation of a project; (ii) consult people, groups of people concerned by the project as well as the general public during preparation of the final EIA; (iii) facilitate access by the communities concerned and general public to the EIA report by the BEEEI; (iv) inform and consult the population on the contents of the EIA report by all appropriate means.

**Nigeria**

Under the ESIA Act public participation in the process is required in accordance with the following stages: (i) Scoping: meet with communities and other stakeholders to document their concerns and obtain their opinions on the project under consideration for inclusion in the study; (ii) Impact Assessment: Consult with the main actors to inform them of mitigation responsibilities; (iii) Review/approval: display the report in designated public places for review and submission of comments by the general public. The display dates and places are announced in the newspapers and on radio stations. The review panel also takes place in public to allow comments and points of view on the project. The date and place of the meeting is announced in newspapers and on the radio.

**International Requirements**

**African Development Bank (AfDB)**

AfDB requirements concerning information and public consultations applicable to the EIA preparation process are set out in operational safeguard (OS) OS1 on environmental and social assessment. One of the specific objectives of OS 1 is “Provide for stakeholders’ participation during the consultation process so that affected communities and stakeholders have timely access to information in suitable forms about Bank operations, and are consulted meaningfully about issues that may affect them”. SO1 stipulates that the borrower or client is responsible for carrying out adequate consultations with communities likely to be affected by environmental and social impacts and with local actors and to provide evidence thereof. The borrower and client are obliged to obtain broad community support especially for projects entailing population displacements of over 200 people (category 1 projects). SO1 also emphasizes that stakeholder consultation must be preceded by the dissemination of adequate environmental and social information to guarantee that the participants are fully informed.

**World Bank (WB)**

WB OP 4.01 on environmental assessment requires that, during the EIA process, the borrower consults project-affected groups and local NGOs about the project's environmental aspects and takes their views into account. The consultation of stakeholders must be initiated as early as possible in the EIA preparation process and must be carried out twice: (a) as part of the preparation of the Terms of Reference for the EIA; and (b) once a draft EIA report is prepared.

**9.2 Public Consultations Carried out as Part of the Preparation of ESIA, ESMP and RAP**

Four methods of public information and consultation were used in the preparation of ESIA and RAP for the North-Core Project. These were used at key stages of the development of the route study, the ESIA, ESMP and RAP where the contribution of stakeholders was considered likely to have a major impact on the ongoing analysis. These are:

- The environmental and social scoping stage (1st round) in December 2014. Its objectives were to: (i) Inform the national authorities concerned on the project and ongoing studies; (ii) Identify the main
challenges concerns and expectations associated with the project and study area; (iii) Complete the list of stakeholders and validate the framework plan for their participation;

- Analysis of the preliminary provisional route (2\textsuperscript{nd} round) March to July 2015. Its objectives were to: (i) involve the stakeholders in the analysis of biodiversity hot spots and resettlements identified along the route being studied;

- Documentation of communities affected and households displaced (3\textsuperscript{rd} round) September to November 2015. Its objectives were to (i) Inform affected communities and involve them in optimizing the route; (ii) Document the concerns and expectations of communities, displaced households in particular women; (iii) Inform affected households of their rights and options with a view to resettlement. and;

- Disclosure of preliminary ESIA, ESMP and RAP findings (4\textsuperscript{th} round) February-March 2016. Its objective was to: (i) Present, validate and improve the ESIA, ESMP and RAP results; and (ii) Ensure compliance of proposed measures with the authorities’ requirements and expectations.

Some community meetings were also held in February 2017 concerning Niger in order to assess the challenges associated with the crossing of two community forests by the final route. The main objective was to confirm that the route could cross the Djandjianiori and Panoma village forests.

In Burkina Faso, a public information and sensitization campaign was carried out in early 2017 to ensure a fair understanding by the affected communities of the project objectives and timeframes, the final route retained and the main conclusions and recommendations formulated by the ESIA and RAP.

The groups of actors targeted by the stakeholder information and consultation process were: (i) National ministries and agencies concerned; (ii) Departmental and municipal authorities and technical services; (iii) Customary authorities; (iv) Communities and households affected by the power line route and installation of sub-stations; (v) NGOs and civil society organizations in the areas of nature conservation, development and human rights.

9.4 Results of Public Consultations for the ESIA

The main concerns and expectations formulated during these consultations concern: (i) the integration of environmental and social considerations in the selection of the power line route; (ii) the submission of the ESIA and RAP report to the technical services after validation; (iii) adequate compensation for losses caused and support for PAP resettlement; (iv) information to, and involvement of, customary authorities and communities in the compensation process and works planning; (v) support to income-generating activities for women; (vi) access to electricity for communities; (vii) use of local labour during construction; (viii) proposals for adequate management measures adapted to the situation in the field.

9.5 Results of Public Consultations with PAP

See summary of Resettlement Plan.

9.6 Future Consultations

Communication Activities during the Pre-Construction/Construction Phase

During the land preparation activities, the clearing of the right-of-way and construction works, the affected communities and other stakeholders will be notified in advance of the nature of the works planned and their timeframes.
Communication Activities during the Operational Phase: During the project operational phase, the following information will be made available to the communities and other stakeholders, in an accessible format and language: (i) the project environmental and social monitoring results; (ii) the planning of right-of-way and equipment maintenance work; (iii) directives on restrictions on the right-of-way use; (iv) public safety dangers associated with the presence of a power line and dangerous behaviour to be prohibited.

The main project administrator of the North-Core Project Unit will be responsible for the entire stakeholder engagement process. The manager in charge of the environment in the project team will assume responsibility for the main duties relating to the project while retaining overall responsibility for the engagement programme and its success.

9.7 Grievance Management System

With regard to conflicts/disagreements that could possibly occur between the developers and PAP, a dedicated grievance management structure will be established and will comprise the following levels: an informal procedure, Departmental level and the judicial process. Any dispute would be resolved more effectively by project management, the civil local administration or other mediation channels acceptable to all parties. These mediation channels could involve customary and traditional conflict resolution institutions. Those responsible for ESMP and RAP management and the person responsible for handling grievances should make every effort to resolve grievances at community level. Legal recourse should be considered as a last resort. At the first level, (informal procedure), the customary chiefs are used to reach an informal conciliation. Grievances may be lodged verbally with the latter. These grievances, in the same way as written grievances, will form part of the grievance management report.

If level 1 arbitration fails, the conflict is transferred to a Conciliation Committee. In the event of failure of the amicable conciliation procedure, legal proceedings will be initiated. The procedure for recourse before the courts is set out in Chapter 3, Articles 12 and 13 of Law No. 2008-37 of 10 July 2008 amending and supplementing Law No. 61-37 of 24 November 1961 regulating expropriation in the public interest and its implementing Decree 2009-224/PRN/MU/H of 12 August 2009.

9.8 National Validation and Disclosure of Reports

All the reports were submitted for validation and disclosure at national level. They were the subject of the following national validation workshops: (i) from 12 to 13 April 2017 with regard to Benin; (ii) from 18 to 19 July 2017 for Burkina Faso; (iii) from 14 to 16 December 2017 for Niger; (iv) in July 2017 for Nigeria.

10. SUMMARY OF ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN COSTS

Some costs relating to the application of mitigation and enhancement measures cannot be specified at this stage of the study. Indeed several of these measures fall under the responsibility of the works contractor with the result that such costs will only be known when the contractor establishes the project construction cost on the basis of the bidding document requirements. The table below provides details of indicative costs by country (excluding rural electrification).
Table of ESMP Costs by Country

<table>
<thead>
<tr>
<th>ACTIVITIES</th>
<th>Benin</th>
<th>Burkina Faso</th>
<th>Niger</th>
<th>Nigeria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1 : Pre-construction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity building for ESMP implementation actors</td>
<td>117850</td>
<td>210000</td>
<td>380000</td>
<td>270000</td>
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<td>Support local communities located near the route</td>
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<td>30000</td>
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<td>60000</td>
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<td>Biodiversity Action Plan</td>
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<td>RAP implementation</td>
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<td>1702692</td>
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<td>Supplementary study/inventories and Stakeholder Engagement Plan</td>
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<tr>
<td>Establishment of mitigation and enhancement measures (PMU, Health Management Plan, IES Monitoring Programme, Vegetation Management Plan, Biodiversity Action Plan, Stakeholder Engagement Plan, 1 year of Stakeholder Engagement, etc.)</td>
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<td>95000</td>
<td>225000</td>
<td>90000</td>
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<td>ESMP implementation monitoring</td>
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<td>30000</td>
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<td>Phase 3 : Operation (5 years)</td>
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<td>Establishment of mitigation and enhancement measures (PMU, Health Management Plan, IES Monitoring Programme, Vegetation Management Plan, Biodiversity Action Plan, Stakeholder Engagement Plan, 1 year of Stakeholder Engagement, etc.)</td>
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<td>Audits</td>
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<td><strong>6094228</strong></td>
<td><strong>5207192</strong></td>
<td><strong>5544850</strong></td>
</tr>
</tbody>
</table>

11. CLIMATE CHANGE

11.1 Main Challenges

Main climate risk: To-date, the best information available and published on the main climatic parameters in relation to the project on the basis of climate data observed and future projections indicates: (i) a steady rise in temperature with slight inter-model variations; (ii) increased frequency and intensity of flooding and temperature ranges. The electricity sub-stations, pylon foundations and electrical cables are, therefore, vulnerable to these climatic risks.

11.2 Adaptation

Adaptation: the design and construction of the transmission line will be carried out in compliance with the best international engineering standards in order to guarantee physical resistance to the main climate risks in the project area. This will presuppose, among others, consideration of: (i) dominant wind speeds; (ii) thermal conditions; (iii) water levels and topography especially for sub-stations and areas crossed by water courses; and (iii) geotechnical conditions for sizing the foundations.
11.3 Mitigation

In terms of mitigation, the project will contribute to the avoidance of greenhouse gas emissions representing 243,090 toe of CO2 per year. This estimate was made on the basis of energy to be injected from Nigeria (based on water and natural gas). Replanting of trees to restore the ecosystem will enhance this positive project impact.

12. INSTITUTIONAL CAPACITIES AND CAPACITY BUILDING PLAN

Successful implementation of the ESMP which will require a closer understanding of the responsibilities of the different actors and their individual involvement in terms of environmental and social management, will be based on an institutional support and capacity building programme focused on the following points:

- Sensitize and train the key project actors (electricity company, bodies responsible for the ESMP validation and implementation monitoring, local authorities, populations, etc.) involved in ESMP implementation, environmental and social monitoring performance as well as the nature of their respective responsibilities;

- Provide electricity companies with the necessary tools techniques and support (technical training, mapping computer tools and stakeholder monitoring, and sampling techniques, etc.) to ensure efficient ESMP implementation;

- Support electricity companies concerning health safety aspects during right-of-way maintenance;

- Form local resettlement committees established by electricity companies;

- Sensitize local communities located near the route on the stakes, dangers, challenges and responsibilities relating to the arrival of the new infrastructure. Indeed, the experience acquired under existing power line projects shows, in particular, that right-of-way fees and accidents involving communities still occur. Such accidents could be minimized by training adapted to these communities as well as the distribution of sensitization materials. Communities may also play a key role as preferred agents for environmental and social supervision and monitoring because of their proximity to the line. Community targeted training will, therefore, contribute to the mitigation of line-related technological risks and maximization of their supervision and monitoring role especially by bird mortality monitoring, nesting monitoring, carcass management etc.

13. CONCLUSION

The ESIAs which are the subject of this summary have largely covered all aspects of a full ESIA. For each country, it recommends an environmental and social management plan whose measures, once implemented are likely to minimize or mitigate the negative impacts identified. Some actions are also planned to enhance the positive impacts identified. Stakeholder consultations were held and are expected to continue throughout the project life cycle. The ESIA has, therefore, met the national regulatory requirements concerning impact assessments and for that reason the countries have already validated the aforementioned reports and issued compliance certificates (except for Burkina Faso where the process is ongoing). The ESIAs also meet the requirements of the Bank’s ISS and its environmental and social assessment procedures. Updates and supplements will be prepared prior to works commencement and this will be one of the conditions of the Bank’s financing agreement.
14. REFERENCES AND CONTACTS

References

The summary was based on the following documents:

**Benin**

**Burkina Faso**

**Niger**

**Nigeria**

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