

**AFRICAN DEVELOPMENT BANK  
ENERGY, ENVIRONMENT AND CLIMATE CHANGE DEPARTMENT**

**REPUBLIC OF CAMEROON  
LOM-PANGAR HYDROELECTRIC PROJECT**

**SUMMARY OF THE ENVIRONMENTAL AND SOCIAL  
IMPACT ASSESSMENT (ESIA)**

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<b>Project Name</b>	<b>Lom-Pangar Hydroelectric Project</b>
<b>Country</b>	<b>Republic of Cameroon</b>
<b>Project Number</b>	<b>P-CM-FA0-006</b>

## **1. INTRODUCTION**

1.1 The African Development Bank intends to contribute to financing the Lom-Pangar Hydroelectric Project. This document summarizes the environmental and socio-economic impact as well as the associated measures of the hydroelectric plant and power transmission line which form part of the Lom-Pangar Hydroelectric Project. The Lom-Pangar project is in line with continuous efforts to unlock the hydroelectric potential of the Sanaga Basin (5 665 MW) after the construction of the Edea uncontrolled stream plant (224 MW) in the 1950s, the Song-Loulou hydroelectric dam (335 MW) in 1988, and the Mbakaou, Bamendjin and Mape impounding dams in 1969, 1974 and 1981, respectively.

1.2 The site selected for the construction of the dam is characterized by the narrow Lom valley situated between two hills. The impounding dam will be 40 m high with a capacity of 6 billion m<sup>3</sup> covering a 540 km<sup>2</sup> area. The plant will be equipped with four generating units, each having a nominal wattage of 7.5 MW for a guaranteed flow of 23 m<sup>3</sup>/s. The power plant and output terminal will cover an area of 1 755 m<sup>2</sup>. The route of the transmission line from the Lom-Pangar project site to Bertoua will run parallel with the secondary road (RD 30) linking the station to Bertoua on a North-South course, skirting 19 villages located along the road.

## **2. PROJECT DESCRIPTION AND JUSTIFICATION**

### **2.1.1 Description**

2.1.1 The project comprises the construction of an impounding dam, a 30 MW hydroelectric plant at the foot of the dam, an HV output terminal and a 90/30 HV terminal in Bertoua. The project includes rural electrification schemes in the East Region of Cameroon with the construction of 740 km MV and LV lines and seventy 50 kVA and 25 kVA distribution sub-stations, and the establishment of 40 000 service entrances and 100 street lighting areas.

2.1.2 The Lom-Pangar Hydroelectric Project underpins the strategy to tap Cameroon's hydroelectric power potential. The tapping and optimization of the 5 600 MW hydroelectric potential of the Sanaga River mainly hinges on the construction of this impounding dam to supply water during the low-flow period to the installations of the Song-Loulou power plant and boost the production of the Edea plant, thus increasing the dependable power of the two plants from 450 MW in 2010 to 659 MW in 2015, with an overall output capacity of 600 GWh. This output may reach 6 500 GWh, upon the completion of the Sanaga terminal located downstream of Lom-Pangar (Nachtigal, Song Dong, Kikot, Song Mbengue, etc.).

2.1.3 The 105 km 90 kV high-voltage transmission line will help to make the network more reliable and electrify some 150 localities in the East Region. It is therefore a continuation of the project to strengthen and extend power transmission and distribution grids which did not cover this region with an ever-growing energy demand. The rehabilitation and extension of the MV/LV grid will increase the supply capacity, while service entrances and

public lighting will help to improve the access of the population to electricity. The Bertoua station will help interconnect the entire network in the East Region which currently has no high-voltage line. The works to be carried out include: (i) the construction of transmission and distribution lines by repowering the 30 KV network operated by AES-SONEL; (ii) the supply of 50% of the installed power of the independent industrial power producers of the region; and (iii) the connection of nine divisional headquarters and 140 localities with a population of more than 200.

2.1.4 In view of its privileged position midway between Yaoundé and Ngaoundere, the project could help to link the Eastern Isolated Grid from Bertoua to the Southern Interconnected Grid by raising the Bertoua-Abong-Mbang and Yaounde-Ayos transmission lines to 90 kV lines, and building a 90 kV line in the Ayos-Abong-Mbang section. The project will mark the start of the interconnection of the Northern Grid pending the execution of the project to link the electrical grids of Cameroon and Chad. Lastly, the implementation of the Electrical Energy Transmission Network Master Plan will provide Cameroon with a reference tool to chart the development of power generation and transmission units throughout the country and to promote trade with neighbouring countries.

2.1.5 The Bank's financing will cover: (a) the construction of the hydroelectric plant to tap the water resources of the Lom and Pangar rivers; (b) the construction of the transmission line; and (c) the electrification of the East Region.

## **2.1.2 Socio-economic Importance**

2.2.1 The induced socio-economic benefits of the project will be visible in areas such as urbanization, education, health, and life and property safety. Electrification will improve the security of hospitals, cold chains and drinking water and the strengthening food safety in rural areas. It will help to establish and improve the functioning of recreational centres. The development of activities will help to generate income, reduce unemployment and improve living conditions in rural areas, thus slowing down rural-to-urban migration of youth and hence halting declining agricultural production and ensuring food security. Electrification will promote urbanization and improve the living environment of the population, the safety of life and property. In the project area, women are responsible for fetching firewood and drinking water, providing domestic lighting as well as processing and preserving food and agricultural produce. Women will be freed from day-to-day and recurrent household chores and, hence, will devote themselves to income-generating activities that can improve the living standards of their families. Besides these benefits, electrification will open up new horizons for teachers and students in the information, training and education domains in the communities concerned. This will further motivate teachers and students, thus improving the school attendance rate and school performance.

2.2.2 Regarding climate warming, the project will contribute to reducing the country's dependence on thermal energy and fossil fuels as well as the greenhouse gas (GHG) emission rate per kWh generated. It will have a multiplier effect leading to the development of similar projects.

2.2.3 In the East Region, the AES-SONEL network covers only 32% of the area. It is not linked to other networks in Cameroon, namely the Southern Interconnected Grid (SIG) and the Northern Grid. Out of a population of about 850 000, only 270 000 people live in areas covered by AES-SONEL in the entire East Region. The rate of distribution was 65% in 2002 and 2003. In 2002, the Bertoua power plant produced 24 872 MWh.

## **2.2 Analysis of Alternatives**

Seven transmission route alternatives were considered, of which three are in the northern and four in the southern parts of the Lom-Panger site. The optimal route was selected after a multi-criteria analysis from the technical, economic, environmental and social standpoints. The line chosen does not cross areas of difficult terrain. The corridor is relatively straight and skirts rural settlement areas, including 19 villages located on the route.

## **3. CAMEROON'S INSTITUTIONAL FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT**

### **3.1.1 Institutional Aspects**

3.1.1 *Inter-ministerial Committee on the Environment (ICE)*: it comprises 17 representatives from ministries concerned with environmental management and is chaired by the Minister in charge of Environment. It expresses an opinion on all environmental impact assessments.

3.1.2 *Ministry of Environment and Protection of Nature (MINEP)*: is in charge of formulating, implementing and evaluating government's environmental policy, including environmental assessment and mainstreaming environmental considerations in all development plans and programmes.

3.1.3 *Ministry of Forestry and Wildlife*: is responsible for formulating, implementing and evaluating government's forestry and wildlife policy. In this capacity, it is particularly responsible for: (1) managing and protecting national forests; and (2) controlling the implementation of reforestation, forest inventory and management programmes.

3.1.4 *Ministry of Energy and Water Resources (MINEE)*: MINEE's mission is to formulate, implement and evaluate government's energy and water production, transportation and distribution policy. It is responsible for developing government's energy and water strategies, and promoting new energies in accordance with Decree No. 2005/87 of 29 March 2005. It is the direct supervisory authority of the Lom-Panger hydroelectric and high-voltage transmission line project in view of its priority position in the energy policy of the East Region. It is the supervisory authority of electricity, gas, oil and water production, transportation, storage and distribution establishments and companies, and the Cameroon Petroleum Depot Company.

### **3.2 Regulatory Aspects**

3.2.1 *Impact Assessments*: the conduct of impact assessments falls within a regulatory framework defined by Cameroon's legislation and guidelines contained in the November 2000 Report of the World Commission on Dams. At the national level, the environmental management policy is based on framework documents, including the National Report on the State of the Environment in Cameroon drafted in preparation for the 1992 Rio Summit, the National Forestry Action Plan (NFAP) of November 1995, the National Environmental Management Plan (NEMP) of February 1996, the Forestry and Environment Sector Plan (FESP) initiated in 1999, and the Cameroon National Biodiversity Action Plan, a strategy paper which is still being prepared.

3.2.2 *The main statutory instruments* related to environmental management and applicable to the project are:

- Law No. 96/12 of 5 August 1996 which lays down the legal framework for environmental management and introduces notably the environmental impact assessment approach. Accordingly, Decree No. 2005/577 of 23 February 2005 lays down procedures for the conduct of environmental impact assessments;
- Law No. 98/15 of 14 July 1998 relating to establishments classified as dangerous, unhealthy or obnoxious in accordance with the principles of environmental management and public health protection;
- Law No. 98/5 of 14 April 1998 laying down regulations governing water resources and provisions to safeguard the principles of environmental management and public health protection;
- Law No. 94/1 of 20 January 1994 laying down forestry, wildlife and fisheries regulations, which seeks to protect and regulate the use of forests, wildlife and fishery resources;
- Law No. 85/9 of 4 July 1985 laying down procedures governing expropriation for public purposes and the conditions for compensation;
- Laws governing the electricity sector.

3.2.3 Framework Law No. 96/12 of 5 August 1996 lays down conditions for the conduct of impact assessments for “*any development, labour or project which may endanger the environment owing to its dimension, nature or the impact of its activities on the natural environment*”. This framework law is supplemented by a series of sector laws and decrees in the environment and energy domains. It determines the basic format of an impact assessment and develops the participatory approach principle. The categories of operations whose implementation is subject to an impact assessment are listed in Order No. 70/MINEP of 22 April 2005 to establish categories of operations subject to environmental impact assessments. It specifies the contents of a summary EIA and a detailed EIA report. Social infrastructure projects like MV/LV electrical networks in rural areas require only a summary EIA. Impact assessment approval procedures are the subject of Order No. 2005/577 of February 2005 which lays down the conditions of admissibility of EIAs and file study fees. The Minister of Environment decides on the admissibility of an impact assessment on the recommendation of the ICE. Other laws are not yet applicable due to the absence of enabling decrees and orders which are still being drafted, namely:

- Law No. 85/9 of 4 July 1985 to lay down procedures governing expropriation for public purposes and the conditions for compensation;
- Law No. 98/22 of 24 December 1998 to govern the electricity sector.

3.2.4 *Statutory Instruments in the Social Domain:* space management and land tenure are governed by some 33 instruments: (i) land tenure: Ordinance 74/1 of 1974; (ii) State lands: Ordinance 74/2 of 1974; (iii) expropriation for a public purpose and terms and conditions of compensation: Ordinance 74/3 of 1974; (iv) terms and conditions for

compensating owners of property destroyed. Civil society is governed by Law No. 99-14 of 22 December 1999 which regulates the functioning of non-governmental organizations (NGOs) and lays down conditions for the emergence of NGOs capable of participating effectively in poverty reduction and the accomplishment of public interest missions. The participation of civil society in the energy sector is very low. Energy policies were formulated without consultation with civil society.

3.2.5 The adoption of the participatory approach and the dissemination of information are mandatory in the conduct of impact assessments. Part IV, Section 74 et seq of Framework Law No. 96-12 of August 1996 contains special provisions concerning impact assessments. Furthermore, the validation of impact assessments is subject to the opinion of the Inter-ministerial Committee on the Environment, which is not made public. This could explain the low participation of the public in the approval of environmental impact assessments, which is an important step in the process. This situation is remedied by donors.

3.2.6 Two main instruments govern women's empowerment: (i) Decree No. 97/148/PM of 8 April 1997 to form a National Steering Committee for the Economic Empowerment of Rural Women and the Improvement of Women's Living Conditions; and (ii) Decree No. 2000/001/PM of 4 January 2000 to organize and lay down the functioning of women's empowerment centres.

3.2.7 **EDC's Environmental Management Capacity:** EDC has a Sub-department of Safety, Environment and Regional Development (SDSEDR) which is one of the four sub-departments<sup>1</sup> of the Lom-Pangar Project Management. SDSEDR is responsible for the day-to-day management, monitoring and evaluation of all environmental and social aspects of the project, notably the supervision of environmental impact assessments, the monitoring of environmental aspects of construction works, the management of compensations, displacements and resettlements, and ESMP implementation. It comprises three services: Safety, Environment and Regional Development.

- (i) **The Safety Service** comprises three units: Site Security, Safety and Health. Its mission will be to secure the Lom-Pangar project area notably by protecting the park, controlling population implosion, etc. It will also ensure site security (life and property safety, road safety, health, etc.).
- (ii) **The Environment Service** will be in the vanguard of ESMP implementation. It comprises three units: Physical and Biological Environments, Monitoring of the Environmental Aspects of Construction Works, and Implementation of the ESMP's Environmental Component. Its mission will be to ensure that field and site operations comply with ISO 14001<sup>2</sup> standards. It is expected to guarantee the integrity and preservation of the ecosystem of the project area by monitoring in particular the level of pollution of the biophysical environment (water, soil, air, ecosystem), to ensure compliance with standards of good environmental practices during construction operations, notably through

<sup>1</sup> The other three sub-departments are: Finance, Civil Engineering and Hydrology, and Electro-mechanics.

<sup>2</sup> **ISO 14001** is the most commonly used standard of the **ISO 14000** series of standards concerning environmental management. Following the ISO 14001 approach closely enables the company to be better perceived by bodies in charge of environmental issues, for instance Regional Directorates of Environment in charge of ensuring compliance with the regulations in force. If a company is ISO 14001 certified, that does not imply that it does not pollute or that it complies with environmental regulations, but only that it has taken steps to try to achieve the objectives it set in its own action plan.

periodic inspections, and to prepare and participate in the implementation as well as monitoring and evaluation of the ESMP of the Lom-Pangar project.

- (iii) **The Regional Development Service** has three units: Social and Economy, Resettlement Action Plan (RAP) Implementation, and Implementation of the ESMP Social Component. It will manage all socio-economic issues related to the Lom-Pangar project. It will be directly responsible for the aspects of RAP implementation regarding the coordination and implementation of establishment, evaluation and compensation operations, and resettlement of people who lost property for a public purpose. It will promote local employment and the participation of local entrepreneurs in the Lom-Pangar project, and maintain cooperation and working relations with non-governmental organizations (NGOs).
- (iv) Concerning human resources, in addition to the SDSEDR Deputy Director and three service heads, 21 senior and junior officers and three administrative officers will be recruited before the approval of the LPHP. The SDSEDR Deputy Director will be under the direct supervision of the Lom-Pangar Project Director, who himself will report directly to the EDC General Manager. The SDSEDR will be responsible for the overall technical oversight of the implementation and monitoring/evaluation of the ESMP as well as the CRP. Under the strategic supervision of the Office of the EDC General Manager and the Project Management, this sub-department will manage several ESMP activities as well as the Permanent Secretariat for the Coordination of Regional Operations, the interface between key Cameroonian ministerial departments, particularly the Ministry of Forestry and Wildlife (MINFOF), as well as COTCO for issues related to the adaptation of the Chad-Cameroon pipeline. Lastly, the SDSEDR will also play a central role in social communication with the local population as well as other civil society, production private sector and media representatives.

3.2.8 ***Decentralized Services of Technical Ministries:*** the services operating in the study area are decentralized services of the Ministries in charge of Environment; Energy and Water Resources; Land Tenure; Territorial Administration; Health, etc. Decentralization, a public administration technique, is based on the principle of community-based management effectiveness; it helps to establish a sphere of specific competences for the benefit of regional and local authorities, and grants them sufficient autonomy in the management of local issues.

3.2.9 ***NGOs:*** NGOs operating in the project area are involved in community forestry development, support to rural entrepreneurs, social development and rural economy (microcredit, savings, household budget, etc.), and HIV/AIDS control. They are also involved in the areas of health, education, housing, subsistence economy and development of non-timber forest products.

## **4. DESCRIPTION OF THE PROJECT ENVIRONMENT**

### **4.1.1 Natural Environment**

4.1.1 The study area is located in the forest-savannah transition zone. Phyto-geographically, this zone is entirely within the semi-deciduous rain forest. In general, the

study area has a wide variety of natural environments with limited species diversity. The evaluation of the importance of the zone in terms of the existence of rare or endemic species is hampered particularly by lack of knowledge on the identification and distribution of plants in the region.

4.1.2 The hydroelectric plant will be located at the foot of the dam of which it is part. The existing biotope consists of river banks and a gallery forest of little importance, giving way to clearings and grassy savannah. Ninety per cent of the sectors crossed by the HV line consist of forest land and 10% of farmland (43 ha). It will be constructed along roads and rural tracks in order to interfere as little as possible with ecosystems.

4.1.3 The natural environment has been altered by human-induced activity. The heavy poaching of wildlife and overexploitation of plants perpetuated a few years back are now being controlled by the Ministry of Forestry and Wildlife with the support of the French Development Agency and companies like CAMRAIL, COTCO and EDC. The zone to the north, along the Deng-Deng National Park, has a very rich wildlife variety, as evidenced by the presence of primates. Its forest habitat, which was once threatened by illegal logging and poaching and which is now under control, is fairly intact. It is thought to contain 200 gorillas and 100 chimpanzees which are fully protected. The zone situated in the south of Deng-Deng along RD 30 is of limited importance with regard to wildlife. It consists of forest habitats that are strongly influenced by the presence of man: dwelling zones, crops, community forests under exploitation, etc.

## 4.2 Human Environment

4.2.1 **Demography:** the population of the area is 8 100 (1 400 households) for 19 localities; the growth rate is said to be low: 1.6% per annum. About 20 different ethnic groups have been identified in the study area, of which three indigenous groups accounting for three-quarters of the population. These include, in order of importance, the Pol (50.2%), the Baya (15.2%) and the Képéré (6.9%). The non-native groups include, in order of importance, the Maka, known as the “Maka of the North” (23.2%), the Bobili (1.6%), the Bamiléké (0.6%), the Hausa (0.4%), the Babouté (0.3%), and the Bassa and Akpwakoum (0.2% each). Then, groups originating in the East Region include the Akpwakoum (0.1%), the Badjoué (0.1%) and the Kaka (0.1%). Groups originating in the Centre include the Ewondo (0.1%), the Mvogkani (Eton, 0.1%), the Bamvélé (0.1%) and the Yambassa (0.1%). Groups from the northern regions include the Bororo (0.1%) and the Bulu (0.1%). Results of focus group discussions revealed the existence other groups like the Condumassa (0.1%) and the Fulfude (0.1%) and finally groups originating in the South Region. In general, the results of focus group discussions conducted in the villages show that relations between the different ethnic groups in the area are very cordial.

4.2.2 Concerning gender, there is wide gender inequality with regard to education and vocational training. Although women play a key role in households, the situation is different outside the family where they are hardly given the opportunity to speak and remain in the background. Two-thirds of houses are traditional; drinking water of poor quality is fetched from wells (56% of families), springs and rivers. The area has six senior government primary schools, one secondary school and two junior government primary schools. Road infrastructure includes the tarred RN 1, the earth ND 30 and several old earth roads. Traders come to collect rural produce. The area has been divided into three health zones (integrated health centres). The main diseases are dysentery, malaria, intestinal parasitic diseases, respiratory infections, STDs and AIDS.

4.2.3 **Economic and Social Activities:** the plant and HV transmission line will be located in a mostly forest and agricultural zone. In the entire project area (including the reservoir and the dam), there are about 19 villages comprising 328 families whose farmlands and forests will be damaged. Agriculture, which is the main economic activity, accounts for 64% of family income, followed by hunting (14%) and fishing (8%). These sectors provide the largest number of jobs in communities and are said to employ about 70% of the active population. Secondary economic activities include stockbreeding (5%), handicraft, logging (3%) and petty trade (4%) which is carried out by men and women depending on the products sold.

4.2.4 **Land Tenure:** two systems, the modern (Land Code of 1974) and the customary law land tenure systems, coexist in Cameroon. Land boundaries are generally marked by fruit trees, forest edges and streams. Conflicts are managed through traditional, customary, or administrative procedures. Land disputes are settled by administrative arbitration as the rural populations do not have a land titling culture. Nevertheless, customary law recognizes land ownership in different villages. All population displacements within the framework of the Lom-Pangar project have been carried out according to the OP 4.12 of the World Bank. There is no land problem in the project area as there is enough arable land. Cameroonian legislation and the World Bank's OP 4.12 are applied. Where these two sets of rules differ, the project will apply the one that is more favourable to people affected by the project. This is the case with houses, for example, which are compensated according to their replacement value (according to World Bank rules) and not on the basis of their actual value (according to Cameroonian law).

4.2.5 **Archaeological Heritage:** it comprises vestiges dating back to the 9<sup>th</sup> and 13<sup>th</sup> centuries, the oldest elements are thought to date back to the Stone Age, indicating that the Lom valley was more populated in the past than today. Sacred sites are said to have been identified in nine villages. These often include trees, sites marked by the presence of water and sometimes artefacts (tombs, esplanade, etc.). It seems that the only archaeological site is the Bertoua grotto.

4.2.6 **Lifestyle:** the population of the project area lead a relatively modern lifestyle. Most villages have generators for lighting and satellite television.

## **5. PROJECT ALTERNATIVES**

The project is indispensable and no environmentally, socially or financially acceptable alternative has been presented. The without-project alternative cannot be chosen because it would prevent the development of the Sanaga basin on which the economy of a large part of the country depends.

## **6. POTENTIAL IMPACT, MITIGATIVE AND COMPENSATORY MEASURES**

### **6.1.1 Impact of Plant Construction**

6.1.1 The entire Lom-Pangar project comprises the following components: (i) the dam per se. The Lom-Pangar impounding dam which is 46 m high covers an area of approximately 540 km<sup>2</sup>, for a payload of 6 billion m<sup>3</sup>; (ii) a hydroelectric plant which lies at the foot of the

dam and has a capacity of 30 MW aimed at increasing the electricity supply capacity in the East Region currently served by diesel-fired power plants. Power will be transmitted to Bertoua by a 105 km-long 90 kV line; (iii) a Belabo-Satando-Mbaki-Mansa-Deng Deng access road and the dam site located near the present Lom-Pangar village; (iv) a workers' camp, a working area and equipment depots on the right bank of the Lom river opposite Lom-Pangar village; and (v) the creation of Deng Deng National Park. This component is a compensatory measure of the dam project. The power plant and high-voltage transmission line project is part of the dam project, without which there would be no need for it. The areas of impact of the two projects overlap. Part of the infrastructure to be constructed (access roads, workers' housing estate) will be for both projects.

**6.1.2 Positive Impact:** the main socio-economic benefits for the population will include the creation of jobs for the local population to offset unemployment in the region; improved road infrastructure and opening up of the area; and improved living conditions. The inevitable deforestation of the site (gallery forest on the banks of the river) is offset by the sale of marketable logs for timber or firewood. The rehabilitation of rural access roads will help open up the surrounding villages for trade.

**6.1.3 Negative Impact:** the construction of the plant will entail the clearing of 210 ha; it will be part of the construction of the dam dyke and will therefore have no specific impact because the effects are similar to those generated by the construction of the dam dyke to which it is joined: the works will impact the modified soil structure; machinery will pollute the air; and dyke works will increase the turbidity of the river. Measures have been taken to reduce water pollution as much as possible. The felling of the gallery forest will have very little negative impact on common flora and marginal terrestrial wildlife. Fish will move depending on the works being carried out and will recolonize the reach after the works. Since the dam and plant are located in a sparsely populated area, no family will be displaced. The domestic site of senior officers and workers necessitated the construction of two platforms in the forest that were completely deforested, but were only partially levelled in order to preserve the landscape value of their respective sites, as specified in the RAP appended hereto.

**6.1.4 Indirect Impact:** the indirect impact of the construction of the hydroelectric plant will include a major oxygen deficit at the bottom layers of the reservoir, during the operation period, associated with low pH value, nitrogenous and phosphorus salt concentrations. This phenomenon will be caused by the decomposition of submerged vegetation, a process that uses oxygen dissolved in water<sup>3</sup>. These in-depth deoxygenated water masses cannot be developed by fishing activities. However, they may be discharged with sludge through periodic bottom draining. The churning of water will help to ensure its re-oxygenation.

## **6.2 Impact of the Construction of HV/MV/LV Lines**

**6.2.1 Positive Impact:** the inhabitants of villages located along the route of the transmission line will be compensated for damage to private property. The socio-economic opportunities offered by the project that are beneficial to the local communities will include: job creation, improved road infrastructure and opening up of some villages, the revival of

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<sup>3</sup> The anaerobic decomposition of organic matter in the soil causes the formation of submerged dissolved elements such as ammonium (NH<sub>4</sub><sup>+</sup>), ferrous iron (Fe<sup>2+</sup>), methane (CH<sub>4</sub>) which is 20 times more harmful than CO<sub>2</sub>, carbon dioxide (CO<sub>2</sub>) and hydrogen sulfide (H<sub>2</sub>S). The amount of greenhouse gas (CH<sub>4</sub> and CO<sub>2</sub>) emitted into the atmosphere depends on the evolution kinetics of these elements in the reservoir.

economic activities, improvement of the living conditions of people living along the line, particularly women (exploitation of arboriculture products and sale of farm produce). Easy access to microcredit in areas directly benefitting from the project will enable the population to invest in different business and craft sectors. The old LV line which previously served the villages and is now abandoned will be rehabilitated and its route will be maintained to minimize impact on the natural environment. Rural electrification will help implement a new approach to development (mechanized grinding of food, possibility of drinking water supply and access to family health and to the cold chain; electrification of schools, dispensaries, houses and development of handicraft activities (mechanical workshops, sheet metal workshops, joinery shops, sewing shops, hairdressing salons, barbershops, etc.); household comfort and access to media like TV, radio, and eventually the Internet.

**6.2.2 *Temporary Negative Impact:*** the construction of the transmission line will necessitate civil engineering works on its route between the dam site and the Bertoua station. The foreseeable impact will be generated by the use of machinery which will result in some modifications of the components of the physical environment (soil compaction and pollution); sound and air quality nuisances will be caused by the operation of machines.

**6.2.3** The impact of the transmission line on Deng-Deng forest biodiversity will be related to the deforestation of a 528 ha corridor; most species of high commercial value have already been exploited by the villages. The regeneration of shrub species along the line will restore a very similar substitution biotope during the line's operation phase. The destruction of endangered, endemic species and loss of biodiversity are unlikely because the corridor is small in size and few endangered species have been identified in the area. However, the installation or development of invasive species due to the disruption of the ecosystem is possible. Their development will be controlled by the regular maintenance of open spaces.

**6.2.4** Construction activities and noises caused by the building of the HV line will disrupt and temporarily displace local wildlife; after the works, the wildlife will return to its former territory and native vegetation will regenerate around the project facilities. The destruction of habitat near the Deng-Deng National Park will affect only a band of between 0 and 50 metres on the eastern edge of the area. The area bordered by the high-voltage line is a marginal fringe of the habitat of large primates; the impact on these species will therefore be limited.

**6.2.5** The loss of farmland will be threefold: (i) temporary loss of use related to the opening up of rural roads and the implantation of construction sites; (ii) loss of use of land associated with the construction of pylons; and (iii) losses related to the development of plots due to the implantation of pylons on irrigated land. There will be no system of spray irrigation via ramps and pins. These different losses will be compensated as specified in the RAP. Land use by the HV line will impose only very few permanent constraints on agricultural activities, unless they are prejudicial to the safety of the line (cutting of fruit trees); they will only result in the establishment of easements. The height of the conductor cables of an overhead power line can be adapted to the nature of traditional farming activities (orchards and irrigation). The main constraint will stem from the presence of pylons which are generally about 300 m apart. The location of pylons somewhat reduces cultivable areas and may impede land development. The opening up of easements in view of their permanent nature may be more constraining than the positioning of the line. It should be recalled that all these constraints are temporary and will disappear at the end of the construction of the line.

6.2.6 With regard to land, pylon construction routes will be temporary just like the passage through seasonal crop farms during the pulling of lines. Conditions under which stockbreeding is carried out will not be disrupted. At the end of construction works, the regeneration of vegetation within the corridor will delimit a new pasture zone. These works could result in the loss of farm income. The presence of foreign workers could spark off relational conflicts in villages along the route during the construction period.

6.2.7 **Permanent Negative Impact:** the area requisitioned for the construction of the plant and transmission line is included in the impact of the dam construction project. The main expected impact will concern the displacement of 16 houses in three villages as the route will be away from villages. The farmland affected by the transmission line is not large as the population density is relatively low: losses will involve 328 households and will concern 41.35 ha of farmland. The number of trees and perennial crops affected is 23 000, of which 5 000 plantains and 9 000 old cacao and coffee trees, and a village rubber plantation (141 trees) in Mansa. There will also be increased pressure on land, increased land clearing, agricultural intensification and soil degradation. No archaeological vestige is listed in the works zone.

6.2.8. According to information obtained from surveys carried out by the HV Line Identification and Assessment Commission (EOC), the different categories of people and property affected are: 19 villages; 855 households; 48 ha, that is 561 m<sup>2</sup> per household, of food crops; 41 149 trees and perennial crops, of which 7 649 banana trees, 7 342 old plantain and 15 051 cacao and coffee trees; 64 tombs, of which 60 earth and 4 cement tombs; 16 houses, of which 11 in Kané, 2 in Koumé Goffi and 3 in Kambo Cassi; 6 round huts, of which 2 in Kano and 4 in Koume Goffi. Therefore, expropriation concerns only 16 families (transmission line site) and has no major socio-cultural and economic impact because the families have been resettled in the same village with their consent. In view of expected population movements and zones that may be more or less disturbed by this population implosion, the total surface area likely to be affected in varying degrees is about 1 666 ha, that is 0.7% of the overall surface area. Electromagnetic waves from the HV line will constitute a health hazard for the population that would decide to illegally build their homes in the line corridor.

### 6.3 Impact during the Plant and Line Operation Phase

6.3.1 **Benefits to the Population:** the power plant and high-voltage transmission line project will first of all benefit the population who will be connected to the electrical grid, mainly the inhabitants of the major towns, notably Bertoua, and rural communities connected to Bertoua by the existing 30 kV line. The impact will include: (i) the improvement of the quality of MV and LV distribution by reducing to a minimum the number and duration of power cuts; and (ii) the development of the economic sector throughout the region. The development of the East interconnected grid should increase the number of inhabitants and, eventually, industries directly benefitting from the project. Therefore, potential benefits will mainly depend on the rural electrification project that will soon be implemented thanks to the construction of the hydroelectric plant at the foot of the Lom-Pangar dam.

6.3.2 **Risks:** the formation of an electric arc or contact of lines with trees can cause a fire in wooded areas. This risk is low but it exists, particularly in the event where cables swing under the effect of the wind or when the vegetation under the lines is too tall. The risk of fire outbreak varies according to season and is logically greater in the dry season. There is also a risk of breakage of cables and falling of pylons under the influence of various factors.

6.3.3 **Positive Impact Enhancement:** it will directly depend on: (i) the quality of equipment maintenance under the responsibility of the Project Supervisor; and (ii) the implementation of a complementary rural electrification project. Easy access to bank loans and microcredit in the direct project areas will enable the population to invest in different business and handicraft sectors which will raise the population's standard of living. Regarding social benefits, the project will help to improve and develop handicraft activities and SMIs/SMEs, as well as the standard of living of the rural and urban population (improvement in housing, job opportunities and development of recreational activities).

6.3.4 A Local Community Development Support Plan (involving 8 000 people) will be included in the construction project. Measures will be taken to establish medium- and long-term financial (microfinance) and monitoring instruments. Recommended actions will include: the protection of the cultural heritage and payment of compensation for damage caused, social infrastructure (construction of schools, rural electrification plan, construction or rehabilitation of drinking water points, agricultural supervision, improvement of farming practices and farmers' organizations and improvement of productivity). An education and health sensitization campaign will be carried out. The operation phase will be characterized by the sustained implementation of the ESMP planned to run for eight to ten years with a mechanism that guarantees the implementation of actions beyond this planned period by establishing a long-term ESMP financing system based on deductions from charges on water or electricity produced by the plant at the foot of the impounding dam. During the operation phase, compensation payments and population displacements will be completed and PAP attendant measures will be more or less at an advanced stage. The project ESMP will go beyond PAPs in terms of compensation actions.

6.3.5 In general, electrification will help to make the living environment pleasant for the entire population. In localities in the project area, many community socio-educational structures (health centres, primary schools, secondary schools, adult literacy centres, etc.) will be built. The difficult and precarious working conditions of the population will be improved thanks to the permanent supply of electricity. School success rates and efficiency of health centres, and other facilities (maternities) will be enhanced. The availability of electricity will also help to develop multimedia centres to hook up the rural communities of the East Region to cyberspace.

6.3.6 **Gender:** in the project area, women account for approximately 52% of the population and are very active in traditional sectors. Eighty per cent of them are actively involved in farming and 20% in petty trade. The permanent supply of electricity will help to free them from recurrent chores so that they can devote themselves to income-generating activities likely to improve their living conditions and reduce poverty. Given the key role that women play in socio-economic activities in the project area, the provision of sufficient and regular power will boost their specific activities (mechanized grinding of food, water supply, sale of water and refrigerated products, catering, handicrafts, dressmaking, dyeing, hairdressing, etc.). Easy access to modern energy, the intensification and acceleration of their substitution for traditional energies to meet household energy needs will have a significant positive impact on the well-being of the target population and their access to the media (radio, TV, education, etc.). Women's household constraints will be reduced gradually to the benefit of educational and/or income-generating activities due to access to electricity.

## 6.4 Impact Mitigation Measures

6.4.1 The decentralized regional services of the key ministries involved in the project (Environment; Energy; Social Affairs; Health; Labour; etc.) will ensure that the measures recommended are effectively implemented. During its works supervision missions, the ADB will also ascertain that operations are properly executed in accordance with project provisions.

6.4.2 *Site Preparation and Works Phase:* before the commencement of works, the local residents will be informed about temporary constraints on access to certain sites for safety reasons. Regarding cultural aspects and in the event of accidental discovery of ancient vestiges, the EDC will report such discovery to the Divisional Office. Construction sites are located far from sensitive sites and will be permanently and clearly marked (by signposts, flashing lights, etc.), and protected by safety barriers defined in coordination with the municipal council's roads service. Diversion routes will be organized. Machines used will comply with the technical and safety standards of their manufacturers and will be equipped with sound-proofing devices to reduce sound nuisance during construction works as much as possible. The level of exhaust fumes will comply with the manufacturer's standards. Soil rammed during construction works will be churned up to restore its natural ventilation and pedological properties; herbaceous, shrubby or woody vegetation destroyed will be replaced. Various wastes will be disposed of; all sites will be rehabilitated.

6.4.3 Domestic sites will have the appropriate health-care facilities required; the sewage and various solid wastes of domestic sites will be collected for disposal. Quarries will be rehabilitated after the completion of works. The EDC will acquire the surface areas needed through amicable agreement. They will be drained and only traffic areas will be concreted. To prevent the risk of contamination of the water table with oils, watertight vats will be constructed and placed under station transformers and connected to an isolated sealed pit to recover any leaks. It should be noted that this type of transformer does not contain pyralene or other liquid dioxin compounds.

6.4.4 All land needed for the construction of transmission lines will be temporarily occupied and could be restored for farming after the completion of works. Works will be executed during the dry season; access roads will be reduced to a strict minimum to ensure the maximum protection of the soil structure and avoid site degradation. Machines will be consistent with international standards and specifications for noise and exhaust fumes. Oils and fuels will be stored off-land in watertight vats to enable the recovery of leakages or accidental spills. Measures will be taken to prevent erosion risks on slopes by building levees (as in terrace cultivation).

6.4.5 Works will preferably be organized after harvests to minimize the cost of compensation for rights-of-way and loss of food crop harvests as much as possible; compressed soil (haulage on access roads) will be churned up at the end of works to a depth of 50 cm. To the extent technical constraints would allow, pylons will be mounted on sites that cause the least inconvenience to crops near paths, roads and boundaries of parcels. The height of pylons will take into account existing constraints (irrigation, orchards, etc.). Contractors will also ensure that project sites are cleaned by removing all debris and residues.

6.4.6 Recruitment, worker management and working conditions must comply with national regulations and international standards. An independent commission will specifically ensure that the following points are respected: (i) the physical fitness of applicants should be evaluated; (ii) each worker will be given basic training on safety and hygiene rules at work sites; and (iii) wages will be equal to or higher than the minimum wage fixed by law. The settlement of workers on the right bank will limit benefits in terms of job opportunities for the population of Ouami, Deng Deng and other localities. The project's ESMP is robust enough to create compensatory economic opportunities (construction of social infrastructure, Touraké bridge, fishing, farming, etc.) for the inhabitants of this area.

6.4.7 The construction of the power plant and transmission line will be preceded by the harvesting of trees located on the line route. The sectors concerned have been targeted and will be exploited by companies already operating in these sectors or will be subject to the signing of specific logging contracts. Most people affected by the project are involved in community forest exploitation in the area.

6.4.8 ***During the Operation Phase:*** periodic maintenance work will be carried out to ensure that the soil is disturbed as little as possible. No direct measures will be taken to reduce noise produced by transformers and transmission lines, except by placing them in locations far away from dwellings and by building appropriate fences. The line route will be regularly maintained (pruning of trees). EDC will, as a precautionary measure, ensure that no house is built under the HV transmission line in view of the health hazards caused by electromagnetic fields. It will compensate all owners of houses located in the danger zone. The visual impact of installations will be offset by plantations which will create a tree screen. The visual impact of the transmission line will be realized by situating the route near the road (to also avoid useless and costly access development works). Fire hazards along the line route will be prevented by regular and standard maintenance of the line and regular cutting of tree branches that can cause short circuiting.

## **7. ENVIRONMENTAL RISK MANAGEMENT**

### **7.1 Greenhouse Gas Emissions**

7.1.1 ***Direct Impact:*** the quantity of GHG produced by the Lom-Pangar impounding dam has been estimated by two thematic studies:

- the study of alternatives is based on data on CO<sub>2</sub> and CH<sub>4</sub> emission from the Petit Saut hydroelectric project in Guyana (3 500 hm<sup>3</sup> for 310 km<sup>2</sup>) as well as on studies carried out on the Nam Theun II project in Laos<sup>4</sup>. The result of estimates, updated for a quantity of submerged vegetation corresponding to about 6.4 million tons of carbon, is 21 million tons of emitted CO<sub>2</sub>;
- according to the study on vegetation, this same quantity is estimated at 24 million tons of CO<sub>2</sub>.

7.1.2 Given the complexity of the phenomena involved and the limited number of experiments successfully carried out, notably in the tropical zone, the theoretical bases and

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<sup>4</sup> These dams were built within a similar bioclimatic context and the size of their reservoir is similar to that of Lom-Pangar. Furthermore, they are the subject of thorough environmental and social monitoring.

measurements of reservoir emissions are still not reliable. However, the results presented above give an acceptable order of magnitude. In fact, the quantity of CO<sub>2</sub> likely to remain in the atmosphere is expected to be less than the quantity released because part will be re-fixed by water. Since this is a global phenomenon, it is difficult to estimate the quantities concerned; some estimates indicate that half of the CO<sub>2</sub> released into the atmosphere is fixed in oceans. If no hydroelectric project is implemented on River Sanaga after Lom-Pangar, the quantity of GHG produced by the equivalent thermal alternative over 100 years is 17 million tons of CO<sub>2</sub> equivalent, compared to 21 million tons emitted by the Lom-Pangar impounding dam. The Lom-Pangar dam alone will therefore produce more GHG than the equivalent thermal alternative.

7.1.3 If one considers the future tapping of the hydroelectric potential of the Sanaga to meet growing energy demand in the medium-term, this result is strongly in favour of Lom-Pangar. The first conclusion is that over the 100-year reference period, the Lom-Pangar impounding dam will emit approximately seven times less GHG than a thermal alternative rendering the same service: 21 million tons as against 140 million tons, on the assumption that the Nachtigal project will be implemented in 2014 in the “status quo” scenario or in 2010 in the “development” scenario. However, distribution over time is different. During the first 7 or 15 years following priming, the Lom-Pangar project will, for the two scenarios, emit more CO<sub>2</sub> equivalent than a thermal alternative playing the same role. The trend will be reversed in the decades ahead: the thermal alternative will continue to emit GHG whereas the dam emissions will drop. The commissioning of new hydroelectric projects (Song Bengue and the extension of Song-Loulou, for example) underscores the advantage of the Lom-Pangar dam in terms of emitted GHG: from the twentieth year, the trend will change in favour of hydroelectricity.

7.1.4 Another factor, the stoppage of photosynthetic activity in growing plant formations increases the level of GHG in the atmosphere. Under normal weather conditions, they form carbon sinks, but will not be able to serve as carbon fixers after the zones concerned are flooded. Among the formations present on the dam right-of-way, only forest regrowth and partly, of course, young forests can be considered as sinks. The forest regrowth and young forests represent approximately 2 400 ha, that is 7.4% to 7.8% of the total forested area. Estimates of carbon fixing by natural forest regrowth in the tropical zone are less than 2 tons of carbon per ha per year for the first 20 years and 0.5 ton of carbon per ha per year for the following years (source IPCC, 1996). The corresponding figures for carbon dioxide are approximately 7 tons and 2 tons. Thus, contribution to greenhouse effect by increasing carbon dioxide content through the flooding of the reservoir would be a little over 600 000 tons of carbon dioxide over 100 years.

7.1.5 ***Indirect and Induced Impact:*** the entire Lom-Pangar project will contribute to climate warming whose indirect effects are many, and are felt worldwide and likely to vary significantly from one area of the globe to another. Many works are underway to sharpen knowledge of consequences at the local level.

7.1.6 ***Compensatory Mechanism:*** the release of greenhouse gases from the decomposition of vegetation in the reservoir will be offset by various measures aimed at preserving biodiversity in the project area: (i) creation of the Deng-Deng National Park (Joint Biodiversity Conservation and Long-term Great Apes Survival Programme); (ii) proper management of the reservoir to reduce the anaerobic decomposition of organic matter by organizing forced marling to enhance aerobic decomposition; (iii) the logging of marketable

timber which can be processed into lumber, which would help to raise CO<sub>2</sub> emission levels from 40 000 tons to 60 000 tons; (iv) increasing the value of timber through charcoal production. Furthermore, two types of complementary actions will be implemented to reduce GHG emissions. The first will act on the quantities of GHG emitted at the beginning of operation of the dam (targeted clearing, partial priming, frequent marling, compensatory afforestation, etc.). The second will be the optimization of the GHG-free power generation chain.

## **7.2 Prevention of Dam Failure Risk**

**7.2.1 Administrative Responsibility:** MINEE, which is the technical supervisory authority of EDC, is also responsible for ensuring that dam construction activities (WB-funded project) are in line with the country's energy policy. The project will appoint an Expert Panel to ensure that the structure complies with trade practices to help reduce failure risk and establish an early warning system. In this connection, MINEE will be particularly responsible for controlling the following aspects: (i) progressive filling (in stages) of the dam according to a plan to be formulated; and (ii) sensitization of the population of the localities located downstream of the dam on potential failure risk and its consequences, as well as on what to do to prevent this risk.

**7.2.2 Risks Run:** dam failure would cause loss of hundreds of lives mainly in the towns and villages located along River Sanaga, but would be significantly reduced with the establishment of an early warning system. The economic consequences would be catastrophic owing to the destruction of many vital facilities.

**7.2.3 Dam Safety Plan:** it will be prepared by the Contractor and will include: (i) the identification of parts of the dam system under construction that may pose problems during the operation of the dam and cause failure; (ii) an internal plan for communication of such information; (iii) the list of actions and decisions taken to increase the dam's robustness and minimize its failure risk; (iv) measurement and warning mechanisms set up to identify and measure defects in sensitive parts; and (v) the procedures established to prevent and/or manage any structural accident during the filling of the dam. The provisional Dam Safety Plan will be presented to the Project Supervisor and the Client not less than six months before the start-up of works for comments. The detailed plan will be submitted not less than four months before the start of works.

## **8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)**

### **8.1 Implementation and Monitoring of the ESMP**

**8.1.1** The ESMP will be implemented under State control by the Sub-department of Safety, Environment and Regional Development of the Lom-Pangar Project, under the Project Director, assisted by a consultant who has already been recruited. Many Cameroonian government departments will be directly involved in the future implementation of the ESMP and, in the short term, the implementation of the CCES. At national level, the departments concerned must include their interventions in their work programmes, but their interventions will be more coordinated at the local/regional level. Accordingly, by a regional decision dated 18 April 2009, the Governor of the East Region established a Monitoring, Facilitation and Support Committee (abbreviated as CSFA) of the Lom-Pangar ESMP, to be chaired by the Governor himself or his representative.

8.1.2 Based on data on the Lom-Pangar ESMP, a plethora of Cameroonian government departments and communities will be involved in the future implementation of the Plan: 18 ministries at the national level, and the representatives of the East Region, the Lom-Pangar ESMP Monitoring, Facilitation and Support Committee, the Lom et Djérem Divisional Office, the Lom et Djérem, and Belabo and Bétaré Oya Sub-divisional Offices and Municipal Councils, at the local level. The efficient implementation of the ESMP will largely depend on the quality of relationships between EDC and the Cameroonian administration.

## 8.1 Schedule

8.2.1 The schedule concerning monitoring by the ADB of the environmental and social component of the project is as follows:

<b>MONITORING OF THE ENVIRONMENTAL AND SOCIAL COMPONENT</b>		
Award and signing of contracts	PIU /Contractor/Consulting Engineer	June 2012
Commencement of works	PIU / Contractor / Consulting Engineer	September 2012
	Establishment: Control and Environmental/Social Monitoring Unit	
Environmental and social supervision	ADB - EDC - MINEP	1 mission every six months
Completion of works	PIU / Contractor / Consulting Engineer	September 2015
Environmental and social audit of works	ADB	
Borrower's project completion report	PIU	November 2015
Project completion report	PIU/ADF	January 2016
Analysis of environmental and social spinoffs	ADF and S/Department of Environment of EDC, MINEP	

## 8.3 Monitoring During the Design and Construction Phases

8.3.1 **Project Team:** from the onset, it has benefitted from advice from the Ministry of Environment, the Ministry of Energy and Water Resources, and the SDSEDR of EDC. During construction works, the Project Supervisor as well as the representatives of the relevant ministries and their regional services will ensure compliance with the laws in force: protection of the physical, natural and human environments. The construction of various engineering structures will be carried out within the framework of a quality control plan in line with the measures contained in the Environmental and Social Management Plan. Contractors in charge of constructing engineering structures will submit their own environmental and social management plans, demonstrating their knowledge of environmental and social issues, for validation by MINEP and EDC before the commencement of work. The main challenges in constructing the impounding dam include wildlife preservation within a context of the risk of population influx and increased poaching,

and illegal logging. The air, soil, and water in the area are of good quality and measures will be taken to ensure their protection during the site preparation phase.

**8.3.2 Measures Recommended:** measures recommended within the framework of the construction of the power plant and HV transmission line are: the formulation of plans for the recruitment of workers for the work sites and the transmission line that meet ADB requirements concerning local employment. The CCES will be developed accordingly; control of access to work sites; management of workers' housing estate, movements and transportation; road safety measures concerning the movement of staff in charge of the transportation of goods produced from construction sites and works; health screening during recruitment and information on STIs, including AIDS; health follow-up in construction sites; site safety plan; waste management during the construction phase; measures to protect animal and plant life; development of a commercial area for local trade; prohibition of the opening of roads near protected areas.

**8.3.3 Responsibility of the Client:** it will be assumed by EDC, while the EDC "Environment" Unit will assume that of the Project Supervisor. Contractors will implement measures while the EDC and the Ministry of Environment will be responsible for control.

**8.3.4 Follow-up of the Construction of the Hydroelectric Plant and Transmission Line:** to reduce cost and the impact on the environment, the construction of the plant will be synchronized with that of the dam. Measures that will be adopted for the dam sites will directly benefit the hydroelectric plant project. Where the plant is constructed after the dam, the site management principles will be the same, but will be implemented on a scale adapted to that of the plant project alone. The construction site, the construction of sub-stations and the transmission line will be carried out independently of that of the plant.

#### **8.4. Monitoring During the Operation Phase**

**8.4.1 Monitoring of Ecosystems and Biodiversity:** the Project Supervisor will work in collaboration with the NGOs involved in primate protection, in particular forest protection. Specific risk sectors will be identified with the help of the NGOs and devices for displaying cables will be positioned in accordance with accepted standards.

**8.4.2 Monitoring of Noise Emissions and Electric and Magnetic Fields:** these parameters will be measured periodically in work stations and in houses near lines and sub-stations. International standards set by WHO for public exposure limits will be respected.

**8.4.3 Follow-up of the Population's Grievances:** as part of the participatory approach involving the population, a grievance register will be opened in the municipal councils covered by various project components. The population will be invited to enter their remarks in the register. EDC will respond to complaints made and take all necessary steps to address them. Where complaints concern radio, TV and computer disruptions, EDC will conduct the necessary investigations to identify the exact cause of the disruptions and ways of addressing them.

**8.5 Supervision Plan:** In light of the numerous environmental and social impacts of the project, a comprehensive supervision plan has been developed. With respect to the ADB, there will be joint missions with operations experts (an environmentalist/ a socio economist)

and environmental and social compliance experts (a safeguards expert). The following table details the supervision plan:

The Supervision Plan

Date	Activity	Mission composition
3 <sup>rd</sup> trimester 2011	Launching	<ul style="list-style-type: none"> <li>• Engineer/ Task Manager</li> <li>• Procurement Expert</li> <li>• Disbursement Expert</li> <li>• Environmentalist/Socio Economist</li> <li>• Safeguards Expert</li> </ul>
1 <sup>st</sup> trimester 2012	Supervision	<ul style="list-style-type: none"> <li>• Engineer/ Task Manager</li> <li>• Environmentalist/Socio Economist</li> <li>• Safeguards Expert</li> </ul>
3 <sup>rd</sup> trimester 2012	Supervision	<ul style="list-style-type: none"> <li>• Engineer/ Task Manager</li> <li>• Economist/ Financial Analyst</li> <li>• Environmentalist/Socio Economist</li> <li>• Safeguards Expert</li> </ul>
2 <sup>nd</sup> trimester 2013	Supervision	<ul style="list-style-type: none"> <li>• Engineer/ Task Manager</li> <li>• Environmentalist/Socio Economist</li> <li>• Safeguards Expert</li> </ul>
4 <sup>th</sup> trimester 2013	Mid-term Review	<ul style="list-style-type: none"> <li>• Engineer/ Task Manager</li> <li>• Disbursement Expert</li> <li>• Environmentalist/Socio Economist</li> <li>• Safeguards Expert</li> </ul>
2 <sup>nd</sup> trimester 2014	Supervision	<ul style="list-style-type: none"> <li>• Engineer/ Task Manager</li> <li>• Environmentalist/Socio Economist</li> <li>• Safeguards Expert</li> </ul>
4 <sup>th</sup> trimester 2014	Supervision	<ul style="list-style-type: none"> <li>• Engineer/ Task Manager</li> <li>• Economist/ Financial Analyst</li> <li>• Environmentalist/Socio Economist</li> <li>• Safeguards Expert</li> </ul>
2 <sup>nd</sup> trimester 2015	Supervision	<ul style="list-style-type: none"> <li>• Engineer/ Task Manager</li> <li>• Environmentalist/Socio Economist</li> <li>• Safeguards Expert</li> </ul>
4 <sup>th</sup> trimester 2015	Supervision	<ul style="list-style-type: none"> <li>• Engineer/ Task Manager</li> <li>• Economist/ Financial Analyst</li> </ul>
2 <sup>nd</sup> trimester 2016	Completion	<ul style="list-style-type: none"> <li>• Engineer/ Task Manager</li> <li>• Economist/ Financial Analyst</li> <li>• Environmentalist/Socio Economist</li> <li>• Safeguards Expert</li> </ul>

**8.6 Financing ESMP Activities:** the Government's plan to mitigate the environmental impact of the entire project (financed by WB, EIB, AFD, ADB, etc.) comprises six main components: (i) mitigation of the biophysical impact, including the Deng-Deng Reserve; (ii)

resettlement and compensation of the affected population; (iii) restoration of the income of the affected rural population; (iv) construction of rural infrastructure (RICP); (v) mitigation of possible impact on health; and (vi) the safety of the population downstream of the dam. The financing of ESMP activities under the ADB project will cover impact caused by the construction of the plant, two sub-stations and a transmission line. The overall budget of the ESMP and RAP will be **CFAF 2.71 billion**. The tables below summarize ESMP and RAP cost breakdown by plan and by component:

<b>SUMMARY OF ESMP COST BREAKDOWN</b>	
<b>Component</b>	<b>CFAF</b>
Protection and consolidation of knowledge of natural environments	33 000 000
Protection of terrestrial habitats and wildlife	429 000 000
<b>Total natural resource management plan</b>	<b>462 000 000</b>
<b>Management of population implosion and personnel movement and transportation of goods during construction</b>	<b>51 000 000</b>
Health and safety during construction	0
Environmental protection	0
<b>Total construction impact management plan</b>	<b>51 000 000</b>
Cross-cutting activities	900 000 000
Compensation and resettlement of the displaced population	RAP
Protection of the cultural heritage and compensation	RAP
Community facilities	125 000 000
Health and drinking water	198 000 000
Support for economic activities: farming and livestock component	306 000 000
<b>Total local community development support plan</b>	<b>1 529 000 000</b>
<b>Grand total</b>	<b>2 042 000 000</b>

<b>SUMMARY OF RAP COST BREAKDOWN</b>	
<b>Component</b>	<b>CFAF</b>
<b>A Individual compensation and resettlement costs</b>	<b>445 125 000</b>
Compensation for fruit trees	227 585 000
Compensation corresponding to one year of food crops	132 000 000
Houses and other buildings	85 540 000
<b>B Collective compensation for villages and camps to be relocated</b>	<b>4 935 000</b>
<b>C Action specific to agriculture</b>	<b>33 000 000</b>
<b>D Project Supervision</b>	<b>75 000 000</b>
Assistance to vulnerable persons and conflict management arrangements	5 000 000
Cost of Technical Unit; Project Supervisor for 3 years	50 000 000
Facilitation by administrative staff, elected officials and chiefdoms	10 000 000
Site monitoring, legal advice	5 000 000
Monitoring and evaluation	2 000 000
Independent audit	3 000 000
<b>Total A+B+C+D</b>	<b>558 060 000</b>
<b>Miscellaneous and contingencies 20 %</b>	<b>111 612 000</b>
<b>Grand total</b>	<b>669 672 000</b>

## **9. PUBLIC CONSULTATION AND DISSEMINATION OF INFORMATION**

**9.1 Information and Public Consultation Mechanisms:** from 2003 to date, EDC has regularly consulted the population and regional authorities during the project design phase and the preliminary identification of the line corridor and sites for the construction of transformer stations. EDC and contractors carrying out topographical works will try to reduce as much as possible the impact on land with the collaboration of landowners affected by the project. All information relating to the conduct of the project will be transmitted to civil society, NGOs, administrative authorities and inhabitants of the project area. Damage to homestead property by line construction works, the opening of access roads, the setting up of construction sites, and the construction of sub-stations has been identified by the Contractor for works, in charge of identifying the damage caused and assessing its cost. The list of persons affected by the project was validated at various administrative and customary levels, and briefings held within the framework of the Identification and Assessment Commission chaired by the Governor of the East Region, and consultations conducted by EDC. The concerned persons are aware of the compensation measures recommended. The consultation of the population will continue during all project phases. A consultation and complaint register has been opened in the Communication Centres set up by EDC to ensure the traceability of such consultation and consideration of the population's expectations.

**9.2 Programming of Meetings:** the Project Supervisor as well as consulting firms held participatory meetings during the preparation of studies. These meetings will continue during the site preparation, works execution and operation phase to:

- relativize the importance of land issues;
- present the importance of the project from a social (public health and education) and socio-economic (development of agricultural and handicraft activities, stockbreeding, food and trade sectors, initiation of SMEs-SMIs, women's empowerment, job creation through power generation) standpoint, as well as improvement of family welfare, etc.;
- present ecological and biodiversity problems;
- show the urgent need to execute the project in view of its positive contribution to: (i) the reduction of pockets of poverty; and (ii) the promotion of development;
- take into account the visual impact of the facilities to be built or rehabilitated;
- etc.

## **10. COMPLIMENTARY INITIATIVES**

### **10.1 Revision of Applicable "Expropriation and Resettlement Procedures"**

10.1.1 EDC has defined the exact positions of all sub-stations as well as routes of lines to be constructed. The total population affected by this project is known and consists of 855 households, of which 16 will be displaced within their localities. So far, dam and plant site preparatory works have not necessitated the displacement of the population. The impact assessments and the ESMP which have been prepared present the resettlement and land acquisition policy framework to be implemented by EDC. It complies with Cameroonian laws and development bank procedures. The ESMP covers: land acquisition for sub-stations and pylons; the relocation of houses located directly under HV lines; compensation for loss of sources of farm income linked to the right-of-way of pylons; compensation for damage due to temporary use of land for access roads and work sites.

10.1.2 The process that will be applied takes into account Cameroonian laws as well as ADB recommendations regarding involuntary resettlement of the population. Concerning developed land, the law provides that the following right holders are entitled to compensation: landowners, tenants or occupants, life tenants, owners of trees or any installation or equipment, and people carrying out a commercial activity on the land. However, the ADB is extending the right to compensation to a third category of displaced persons who do not have a legal right or customary claim over the land they occupy in the project area. They will be entitled to resettlement assistance in lieu of compensation. Without infringing Cameroonian laws, at least land, houses and facilities will be placed at the disposal of this marginalized population<sup>5</sup>.

## **10.2 EDC's Capacity Building Programme**

10.2.1 Under the project, a feasibility study to build the institutional capacity of the 19 ministries involved in the project and its environmental and social impact will be carried out. The needs identified, worth a total of CFAF 3.2 billion, will concern technical (particularly logistic support) as well as human capacity building, with the recruitment of more personnel, the implementation of appropriate training programmes and acquisition of necessary documents. The budget is distributed over the four years of project implementation.

10.2.2 For its part, EDC has a Sub-department of Safety, Environment and Regional Development (SDSEDR) comprising a Safety Service, an Environment Service and a Regional Development Service supported by environment and social affairs experts. This sub-department, which will supervise the implementation of the project and monitor its operation, is currently assisted by an international expert. One of the first tasks assigned this consultant is to define and assess the specific environmental and social needs of EDC. In its capacity as Project Supervisor, EDC is responsible for monitoring the RAP. Furthermore, environmental and social audits will be carried out periodically during project preparation and implementation.

## **10.3 Other Actions Planned by the ADB**

10.1.1 The Environmental and Social Management component of the project includes individual compensation and resettlement, collective compensation of villages and camps, specific agricultural activities, environmental monitoring as well as information, education, and communication campaign (IEC) on the negative impact of the project and recommended mitigative measures, as well as actions to control energy use (MCE), which will contribute to sensitizing subscribers to ensure less and judicious consumption of available electrical energy. The project will also carry out specific commercial activities to increase the number of subscribers and cover as many people as possible, particularly the most underprivileged segment of the population. It will also introduce prepayment meters to reduce non-technical losses and fraud.

## **11. CONCLUSION**

11.1 The project components financed by the ADB, namely the hydroelectric plant, the sub-station and the HV transmission line, have been classified under the Bank's

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<sup>5</sup> These include indigenous groups, ethnic, religious and linguistic minorities and stockbreeders that may have rights of usufruct over land and other resources expropriated for the project.

Environmental and Social Category 1. They were the subject of detailed environmental and social assessments conducted within the framework of the overall environmental and social assessment of the entire project. An Environmental and Social Management Plan specific to the ADB project has been prepared.

11.2 The corridor of the HV power transmission line will necessitate the felling and pruning of trees (approximately 528 ha of forest ecosystem); some sections of the line will be located in wetlands (marshes). The socio-economic impact will boil down to the destruction of food crops (about 48 ha). The Deng-Deng National Park covering a surface area of nearly 59 000 ha has been set up to compensate for the loss of biodiversity due to the construction of the dam and creation of the reservoir.

11.3 During the operation phase, the impact in the interconnected zones will, on the whole, be positive and will mainly concern social domains (new opportunities for economic diversification and enhanced public service efficiency). The project takes into account climate warming by developing a significant hydropower potential. The Bertoua thermal power plant will be shut down, but will be maintained as ancillary equipment.

## **12. REFERENCES AND CONTACTS**

12.1 The feasibility studies of the dam and transmission line were completed in 2006. The final designs of the dam, hydroelectric plant and transmission line were completed in 2010. Feasibility studies for the electrification of the East Region were completed in 2007 and the final designs in 2009. The socio-economic surveys of the area were conducted in 2008 and environmental and social impact assessments were finalized in 2011 with World Bank financing. The studies include the Environmental and Social Management Plan (ESMP) incorporating the Natural Resources Management Plan (NRMP), the Construction Impact Management Plan (CIMP), the Local Community Development Support Plan (LCDSP) and the Compensation and Resettlement Plan (CRP).

12.2 The following studies were carried out on behalf of Cameroon's Electricity Sector Regulatory Agency (ARSEL) and the Ministry of Energy and Water Resources:

- (i) Reformulation of the Impact Assessment and Environmental and Social Management Plan of the Lom-Pangar Dam - Compensation and Resettlement Plan (CRP) of the Plant and Transmission Line Component, January 2011;
- (ii) Reformulation of the Impact Assessment and Environmental and Social Management Plan of the Lom-Pangar Dam, January 2011;
- (iii) Lom-Pangar Dam Project - Regional Development Plan, January 2011;
- (iv) Cumulative Impact Assessment of the Lom-Pangar Dam Project, including a Regional Development Plan, October 2010;
- (v) Reformulation of the Environmental and Social Assessment of the Lom-Pangar Hydroelectric Project. Environmental and Social Assessment (ESA) Report, January 2011;
- (vi) Background of the Integration of Environmental and Social Aspects in the Project Design, July 2010;

- (vii) Feasibility Study of the Archaeological Resource Management Plan, January 2011;
- (viii) Implementation of Compensation for Biodiversity: Deng-Deng National Park, January 2011;
- (ix) Progress Report of the Health Component, January 2011;
- (x) Institutional Capacity Building Feasibility Study, June 2010.

## 12.3 CONTACTS

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