ECONOMIC COMMUNITY OF WEST AFRICAN STATES
COMMUNUATE ECONOMIQUE DES ETATS DE L'AFRIQUE DE L'OUEST
COMUNIDADE ECONOMICA DOS ESTADOS DA AFRICA DO OESTE

Guidelines for Environmental and Social Impact Assessment of Electric Power Generation & Transmission Systems in West Africa

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FOREWORD

The Economic Community of West African States pursues a specific vision in the field of environmental protection and management. This vision includes:

- Enabling accelerated and harmonized development to improve regional economic integration in West Africa; and

- Establishing a strategic framework for the sustainable protection of the environment and management of natural resources while developing electric power generation and transmission infrastructure needed by the region.

The purpose of the ECOWAS Environmental and Social Impact Assessment Guidelines for Power Generation & Transmission is to facilitate preparation and evaluation environmental and social impact assessment studies with respect to national and supra-national electrification projects, and, in particular, those dealing with construction and operation of thermal power generation units, hydroelectric schemes and transmission lines.

The Guidelines provide a detailed overview of an ESIA process, its role and place in the decision-making process, methodology and specific environmental issues relating to electric power transmission and generation projects.

Promoters of regional and national electricity sector development projects must comply with the EIA procedures of the international financing institutions that serve as their development partners. They equally need to comply with the EIA procedures of the individual countries on whose territory the project is planned for development. The Guidelines explain the principles of the international financing institutions' environmental requirements as well as administrative procedures and describe those of the individual ECOWAS Member States.

The Guidelines' legal status and contents were discussed in detail by the WAPP experts, representatives of the Member States environmental Agencies and authorities at a seminar held within the framework of the WAPP working meetings in Accra, Ghana on 15 – 16 of April 2004.

The experts made a decision to adopt the Guidelines as a reference document that shall be used for the EIA studies relating to electric power generation and transmission projects in the ECOWAS region. It was also recommended to create a WAPP Environmental Committee in charge of such tasks as:

- To ensure facilitation and monitoring of the environmental impact studies of the WAPP priority projects.

- To continue the effort of harmonising the environmental impact studies procedures for the electric power generation and transmission in the West Africa region.

- To define the common norms and standards for the Members states.

- To initiate actions for capacity building at the national level in order to improve the EIA process of the electricity sector projects.

These Guidelines were elaborated to support the requirements imposed by financing institutions and national legislations. They are mandatory to serve as a reference for those involved in the preparation and commissioning of environmental impact assessment studies of electricity projects in West Africa. However, it is the responsibility of those in charge of environmental impact assessments to ensure compliance with specific requirements and standards of appropriate international financing institutions and national legislations.

The ESIA Guidelines for Electric Power Generation & Transmission have been prepared by the ECOWAS Executive Secretariat Energy Division in close cooperation with national electric power utilities and environmental authorities in the ECOWAS Member States with financial assistance of the United States Agency for International Development under Contract N° LAG-I-00-99-00019-00, Task Order 805, implemented by PA Government Services, Inc.

The project team would like to acknowledge the Southern African Power Pool Environmental Sub-committee and the E7 Network of Expertise for the Global Environment for the kind permission to use their respective environmental manuals.

We would also like to recognise to WAPP development partners – African Development Bank, European Commission, European Investment Bank, the World Bank Group and USAID – for their valuable comments, which helped to better outline the Guidelines and define the focus for future action in the environmental field.

And last but not least, special thanks are addressed to the national electric utility companies, authorities in charge of environmental protection of the ECOWAS Member States for their active participation in the elaboration of these Guidelines.

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LIST OF ABBREVIATIONS

ADB	African Development Bank
ANDE	National Environmental Agency (Côte d'Ivoire)
AZITO	AZITO Thermal Power Plant (AZITO Energie)
BEA	Benin Environmental Agency (ABE)
BEIS	Bureau of Environmental Impact Studies (Côte d'Ivoire)
CEB	Communauté électrique du Bénin
CESD	Centre for Environmentally Sustainable Development
CIE	Compagnie ivoirienne d'électricité
CIPREL	Compagnie ivoirienne de production d'électricité
DECE	Directorate of Environment and Classified Establishments (Senegal)
DFID	Department for Foreign International Development (United Kingdom)
DNE	Direction nationale de l'environnement (Guinea)
EA	Environmental Assessment
EAP	Environmental Action Plan
ECOWAS	Economic Community of West African States
EDG	Electricité de Guinée
EDM	Energie du Mali – s.a.
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMF	Electromagnetic Fields
EMP	Environmental Management Plan
EMS	Environmental Management System
EPA	Environmental Protection Agency
EPD	Environment Protection Department (Sierra Leone)
EPSD	Environmental Plan for Sustainable Development
ESIA	Environmental and Social Impact Assessment
EU	Environmental Unit
FEPA	Federal Environmental Protection Agency
GEAP	Gambia Environmental Action Plan
GHG	Greenhouse gas
HEP	Hydroelectric project
HV	High Voltage
IEE	Initial environmental evaluation
IFC	International Financing Corporation
IFI	International financing institution
IIED	International Institute for Environment and Development
IPP	Independent power producer

ESIA	Environmental and Social Impact Assessment
LEC	Liberia Electricity Corporation
LSM	Lead Sectoral Ministry (Sierra Leone)
MOU	Memorandum of Understanding
NAWEC	National Water and Electricity Company Ltd (The Gambia)
NCSED	National Council for Environment and Sustainable Development
NDE	National Directorate of Environment (Guinea)
NEAP	National Environmental Action Plan
NEPA	National Electrical Power Authority (Nigeria)
NEPB	National Environmental Protection Board (Sierra Leone)
NGO	Non-government organization
NIGELEC	Société nigérienne d'électricité
NPA	National Power Authority (Sierra Leone)
NPEM	National Programme for Environmental Management (Togo)
NPPE	National Policy for Protection of Environment
NEAP	National Environmental Action Plan
NPESD	National Plan for Environment and Sustainable Development
OMVG	Organisation pour la mise en valeur du fleuve Gambie
OMVS	Organisation pour la mise en valeur du fleuve Sénégal
ROW	Right of Way
SAPP	Southern African Power Pool
SBEE	Société béninoise d'électricité et d'eau
SEA	Strategic Environmental Assessment
SENELEC	Société d'électricité du Sénégal
SES	Socio-economic studies
SOGEM	Société de gestion d'énergie Manantali
SONABEL	Société nationale d'électricité de Burkina Faso
SOPIE	Société d'opération ivoirienne d'électricité
TOR	Terms of Reference
USAID	United States Agency for International Development
UNDP	United Nations Development Programme
UNEP	United Nations Environmental Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
VRA	Volta River Authority (Ghana)
WAPP	West Africa Power Pool
WB	The World Bank Group
WBCSD	World Business Council for Sustainable Development

1. ESIA GUIDELINES FOR ELECTRIC POWER GENERATION & TRANSMISSION SYSTEMS

1.1. Regional Power Market Development in West Africa

In West Africa, the first inter-state electric power transmission lines were commissioned in 1971. Ten years later, ECOWAS introduced its first regional energy policy known as "energy of survival" *(l'énergie de survie)*. In 2000, the ECOWAS Member States signed a Memorandum of Understanding (MOU) calling for creation of the West Africa Power Pool (WAPP).

At this stage of its implementation, WAPP is not a power pool in the traditional sense that the term "power pool" is used in the electricity industry. Rather, WAPP is a regional power market development project undertaken under the auspices of a regional economic integration and development organization. WAPP is not limited exclusively to the traditional power pooling technical functions, but also encompasses economic, legal and social issues relating to the establishment of an organised regional marketplace.

1.2. West Africa Power Pool Mission and Objectives

WAPP's **Mission** is to develop a sustainable regional electricity supply system leading to promotion of economic growth of the ECOWAS region.

The following **Statement of Objectives** was established for the WAPP by the Member States' Ministers of Energy in Accra in April 2002:

1. To institutionalise more formal and extensive regional co-operation in the development of cost-effective electricity infrastructure and energy trading networks in order to increase energy supply and enhance energy security within the region;
2. To improve electricity system reliability and power quality throughout the region;
3. To lower electricity system costs by:
   - Increasing economic trading of both power and energy within the region;
   - Optimising the utilisation of energy resources in the region; and
   - Managing more effectively and efficiently the region's seasonal and weather-related imbalances.
4. To reduce the overall amount of capital needed for electricity system expansion in the region by promoting implementation of "bankable" projects on a least-cost basis;
5. To create an investment environment for the region's power sector that will facilitate the financing of priority generation and transmission projects;
6. To create an ongoing forum in which regional power issues can be discussed and worked out within an agreed-upon policy framework and set of operating principles;
7. To create a transparent and reliable mechanism for the prompt settlement of commercial electricity transactions;

8. To increase the overall level of electricity service within the region through the implementation of priority generation and transmission projects as the basis for economic development and the extension of paid-for electrical service to more consumers.

1.3. WAPP Implementation Strategy

The West Africa Power Pool implementation strategy simultaneously pursues the following tasks:

A. Expansion of the interconnected infrastructure, including:

   A.1. Construction of international transmission lines and ancillary facilities to increase geographic extent of the WAPP grid and electric power trading.

   A.2. Installation of facilities, hardware, and software to manage international control and dispatch.

   A.3. Development of local engineering and commercial know-how to maximize technical and economic efficiency of new interconnection lines.

B. Parallel development of the WAPP governance, including:

   B.1. Creation of the WAPP institutional entity charged with organization and promotion of the regional wholesale electricity market.

   B.2. Development of independent regional regulation.

   B.3. Creation of an investor friendly environment in the regional electric power sector to promote proliferation of investor-owned projects.

C. Capacity building in national Ministries, electric operating entities, and other organizations involved in the electric sector, to facilitate interaction with the WAPP governance structure.

1.4. Purpose of the ECOWAS ESIA Guidelines for Electric Power Generation & Transmission Systems

Coordinated development of the regional electric power transmission and generation infrastructure is carried out with the help of international financing institutions, using developers' own funds or a mixture of both. On one hand, it is a normal practice among financial donors to request a submission of an environmental impact assessment study as a condition to the provision of funding. On the other hand, West African countries are also becoming increasingly aware of the environmental degradation resulting from development activities in various economic sectors, including the electricity industry. Most of the countries in West Africa regulate environmental aspects of economic development activities.

Electricity sector development projects are likely to produce significant impacts both on biophysical and social environment during construction, operation and post-operation phases. The high voltage transmission lines are subject to environmental control due to the right of way implications and impact of electromagnetic fields they emit. Thermal power generation plants affect quality of the ambient air, pollute water resources and contribute to the increase in noise levels. Hydropower dams affect flora and fauna in the flooding areas and might lead to resettlement of a significant number of people.

Having been forced to face various degrees of environmental degradation in the past decades, ECOWAS Member States and utility companies are keen on integrating environmental concerns in their decision-making process at the earliest possible phase of project development. Given the importance of the sector for the overall regional economic development and the specific nature of environmental impacts of various electrification activities, it became necessary to develop the regional EIA Guidelines for Electric Power Generation & Transmission Systems.

The purpose of these Guidelines is to assist participating Member States, national utility companies and other stakeholders in preparing, conducting and evaluating EIAs with respect to the national and international electrification projects, and, in particular, those dealing with construction and operation of transmission lines, thermal power generation units, and hydropower dams and plants.

1.5. Structure of the Guidelines

The Guidelines are structured as follows:

Section 1: ESIA Guidelines for Electric Power Generation & Transmission Systems

This section provides overview of the West Africa Power Pool as a West Africa power market development project. It explains the project's mission and objectives, its implementation strategy and establishes the need for environmental impact assessment as an integral part of the decision-making process during construction, operation and post-operation phases of electricity sector development projects.

Section 2: EIA Background

Section 2 provides background information on the EIA process. It briefly describes its evolution, general purpose and objectives, and role in the decision-making process. It also describes the interests of different stakeholders in electrification projects.

In addition, this section contains an analysis of the role of international financing institutions (IFIs) in development of EIAs. A list of Internet links to information about the EIA requirements of the IFIs that show active interest in the WAPP-related projects is provided so that national utilities and other interested parties could refer to multilateral funding agencies' EIA guidelines when preparing a development project.

Finally, the environmental standards relevant to the electric power industry as defined by the World Bank's operational policy are listed for reference in this section.

Section 3: Environmental Impact Assessment Procedures in the ECOWAS Member States

This section describes EIA procedures, standards and associated statutory requirements, as they presently exist in each ECOWAS Member state. The description of environmental management issues follows the same logic for each country:

1. Legal and regulatory framework
2. The EIA process
3. Implications for the electricity sector
4. National legal references
5. Institutions to contact in the country.

Any omission from the above approach results from unavailable information from a particular country.

Section 4: The EIA Process

This section introduces a step-by-step framework for the process of organising an EIA for a power generation or transmission project. A generic EIA process is adapted to the West African context. The following EIA process phases are described in this section:

- Project definition
- Screening (Preliminary EIA)
- Scoping
- Baseline data (with respect to the physical, biological and socio-cultural components of environment)
- Impacts prediction
- Impacts assessment
- Mitigation measures
- EIA review
- Implementation
- Monitoring

The key issues relevant to each of the aforementioned phases are analysed in depth. Special consideration is given to public participation that should be organised throughout the entire EIA process.

Section 5: Specific Features of EIA for Thermal Power Plant Projects

This section describes specific environmental features of thermal power plant projects. The pattern of thermal generation capacity expansion in the ECOWAS region implies that environmental impact of this activity will be related to (a) rehabilitation of the existing power plants, (b) construction of new generation facilities, and (c) operation of thermal power plants. Potential impacts of all these activities are discussed with special attention given to pollution control measures and other harmful affects and nuisances.

Section 6: Specific Features of EIA for Hydroelectric Projects

Section seven provides a description of environmental impacts specific to hydroelectric projects. Consideration is given to consequences that hydroelectric schemes have on the natural (physical and biophysical) and socio-economic environment. Past experience evaluating the environmental impacts of hydroelectric schemes in West Africa is utilised to highlight the magnitude of such impacts.

Section 7: Specific Features of EIA for Transmission Lines Projects

Section 5 describes specific features of EIA for high voltage (HV) transmission lines. The key areas where transmission lines are likely to produce significant impacts on the environment are described with respect to the line's length, size and spacing of the pylons, ancillary infrastructure such as access roads, switch yards and substations and the sensitivity of the environment in which the project is planned.

The potential environmental consequences of transmission line projects are analysed both for the construction and operation phases.

Section 8: EIA Case Studies

AFAM V Thermal Power Plant (Nigeria). Known as AFAM V, this project involves construction of two new power generation units with total capacity of 276.38 MW and associated facilities within the existing NEPA Power Station. The units will be using gas turbines burning natural gas to be supplied by Nigerian Gas Company.

The project's EIA dealt with the identification of environmental impacts typically associated with thermal power plant projects. Specifically, the analysis of the existing environment and identification of likely impacts in this case are quite helpful in understanding the environmental assessment approach specific to thermal power plants.

Bumbuna Hydroelectric Project (Sierra Leone). This case study offers an example of a comprehensive EIA prepared for the Bumbuna hydroelectric project in Republic of Sierra Leone. It is an illustration of a classical EIA approach. It starts with the project description and rationale, describes the existing environment in the project area, analyses the project's environmental impacts and suggests the appropriate mitigation measures.

CEB – NEPA Interconnection (Benin/Togo – Nigeria). The high voltage transmission line project between Nigeria and Benin is one of WAPP's priorities. It will permit to tie Nigeria's grid to the interconnected section extending from Benin and Togo to Ghana and Côte d'Ivoire. A new interconnection between Côte d'Ivoire and Mali will eventually help to span the whole region from Nigeria in the east to Senegal in the west.

The project has been under discussion for a number of years and is now nearing the construction phase. The EIA study carried out for the project is a typical example of an assessment of environmental impact of a high voltage transmission line passing through various areas.

Glossary

The glossary defines the specific terms used in the international environment arena and the Guidelines.

List of Symbols and Technical Terms

This is a list of symbols and technical terms used for setting environmental effluent discharge and gaseous emissions standards. It is provided for easy reference as most of the symbols and technical terms explained in the list are used in the text of these Guidelines.

List of Sources

This is a list of sources of information used to prepare the ECOWAS ESIA Guidelines. If necessary, it can be used as a list of references for further research.

2. EIA BACKGROUND

2.1. What is an EIA?

An Environmental Impact Assessment (EIA) is a systematic process used to identify, predict and assess potential impacts of proposed development projects, programmes, plans or legislative actions on physical, chemical, biological, cultural and socio-economic components of the surrounding environment. A sound EIA process includes all stakeholders and maximizes public participation to the greatest extent possible.

EIAs are a highly successful policy instrument developed in response to the growing concern to curb the negative impacts of economic activities on the environment. The concept of EIA was first introduced as part of the US National Environmental Policy Act (NEPA) in 1969. The EIA process has evolved over the last 30 years and is now widely used as a tool for sustainable development planning and management. The process continues to evolve through innovations in legislation, procedures, tools and methodology throughout the world, including West Africa.

One of the recent developments in the area of environmental assessment of economic development activities took place at the European Union with the introduction of the concept of Strategic Environmental Assessments (SEA) in 2001.[1]

Strategic Environmental Assessments are studies analogous to EIAs but different from them because instead of focussing on "projects", they concentrate on plans, programmes, policies etc. Thus, the SEAs are used for planning of economic development in general and at a larger scale.

A good quality SEA process informs planners, decision-makers and affected public on the sustainability of strategic decisions, facilitates the search for best alternatives and ensures a participative decision-making process. This enhances the credibility of decisions and leads to more cost- and time-effective EIA at the project level.

Alternatives analysis in environmental assessment is designed to bring environmental and social considerations into the "upstream" stages of development planning -- project identification and earlier -- as well as the later stages of site selection, design and implementation.

In the absence of such consideration, those steps in the project cycle are taken solely on the basis of technical feasibility, economics, and political preferences, and the EA for such a project tends to be directed to supporting or affirming a project proposal. At best, EA becomes a damage limitation exercise, with the benefits restricted to identification of mitigation measures.

World Bank Environmental Assessment Sourcebook Update. Number 17. December 1996.

[1] Directive 2001/42/EC of the European Parliament and of the Council on the assessment of the effects of certain plans and programmes on the environment – "the SEA Directive" – entered into force on 21 July 2001.

Most of the ECOWAS Member States have adopted the EIA process and put in place legal provisions to ensure it is used to support national and local sustainable development projects. The general regulatory requirement is that EIAs be initiated at the initial phase of a development activity planning. Results of the EIAs are used for informed decision-making about short-, medium- and long-term environmental consequences of particular development initiatives.

2.2. What are the EIA Objectives?

Environmental impact assessments are both a process and a tool for project planning and decision-making. Their objectives are to:

- Integrate environmental considerations in planning of development activities;
- Ensure that economic development projects meet legal requirements related to environmental protection and prevent deterministic decision-making;
- Carry out environmental and social impact assessment studies of projects in parallel with analyses of their technical and economic feasibility;
- Ensure that decision makers are provided with information about a project's environmental costs and benefits in addition to its technical and economic viability at key decision points during project preparation and implementation;
- Ensure that provisions are made to avoid or mitigate unwanted negative impacts at an early stage in the planning process;
- Assist decision makers in evaluating possible negative impacts on social, historical and cultural heritage;
- Ensure participation of all stakeholders in the decision-making process;
- Ensure that all affected and interested groups (communities, government agencies, public, project developers and development partners, etc) are informed about the project, its impact on the environment and are able to contribute to project development; and
- Set up an environmental monitoring system for projects during the commissioning, operation and de-commissioning phases.

The primary purpose of the EIA process is to ensure that environmental concerns are taken into account in planning and decision-making.

2.3. Who is involved in EIAs?

The responsibility for conducting an EIA normally lies with the company or organization that is promoting a project or may eventually own it - known as the project proponent, promoter or developer.

An EIA for an electrification project may concern different stakeholders with varying degrees of involvement. Typically, the stakeholders involved in EIAs of electrification projects include:

- Project proponent and other beneficiaries
- Government agencies
- Environment consultancy firms
- Local population – individuals, groups and communities – who are affected or likely to be affected by the proposal

- NGOs and interest groups
- Others, such as development partners, academics etc.

Project Proponents

Project proponents facilitate the acceptance of the proposal through provision of relevant information. Project design can be improved through public input on alternatives and mitigation approaches and better understanding of local values.

Government Agencies

The government agencies involved in the EIA process ensure that regulatory requirements are reflected in impact analysis and mitigation consideration. They also make sure that public involvement is organized in compliance with the established rules and procedures.

Environment Consultancy Firms

The high quality of environmental impact research, studies and statements directly depends on the environment consultants' capacity and experience.

Local Population

Individuals or groups in the affected community must be informed of the project and its likely impacts. Also, they must be given the opportunity to provide input and express their opinions. They should be assured that their views will be carefully listened to and considered. Their first-hand knowledge of the local environment and values can provide significant input during baseline data collection.

Non-governmental Organizations / Interest Groups

Input from NGOs can provide a useful policy perspective on a proposal. Such input is helpful when difficulties arise while involving local people. Involvement of other interest groups like academia and sectoral experts should be encouraged to gain wide acceptance of the EIA study.

2.4. EIA Requirements of International Financing Institutions

2.4.1. Role of International Financing Institutions

International financing institutions (IFIs), such as the African Development Bank, European Investment Bank, European Commission, French Development Agency and the World Bank/IFC, as well as development agencies, such as the US Agency for International Development (USAID) have become driving forces behind the widespread use of EIAs. These institutions use environmental assessments (EA) to examine the potential environmental risks and benefits associated with their lending operations and provide development funding subject to proven environmental soundness and sustainability of proposed projects.

The International Financing Institutions (IFIs) are committed to the implementation of the Millennium Development Goals defined by the United Nations at the Millennium Summit held in New York In September 2000. This includes Millennium Goal N^{o} 7, which aims to ensure environmental sustainability through integration of the principles of sustainable development into country policies and programmes and reversal of the loss of environmental resources.

The WAPP benefits from the financial involvement of a number of IFIs interested in the development of regional electricity infrastructure and new market arrangements in West Africa. As a rule, the WAPP development partners require submission of an EIA prior to making investment decisions. Many of such institutions have well-established EIA procedures, which apply to their lending activities undertaken by borrowing countries.

Electricity sector operators in West African countries pursuing the regional energy sector integration are respectful of the EIA requirements from the development partners. The procedures are thoroughly followed during preparation of each project. Furthermore, EIA policies established by IFIs and development agencies are often used in countries that have insufficient domestic environmental legislation.

2.4.2. Guiding Principles

The following are the common principles of EIA guidelines from the various IFIs:

- EIA is a tool for achieving sustainable development.
- EIA must be integral part of a wider Strategic Environmental Assessment (SEA) process to ensure that all realistic alternatives to a particular economic development have been scrutinised at a higher decision-making level.
- EIA should be integrated into national development planning and authorisation procedures.
- EIA should be a process rather than a specific product.
- The EIA process should be integrated into development projects design and implementation at the earliest possible stages to reduce cost and increase efficiency.
- EIA is a management tool to be closely integrated into the project life cycle and its critical decision points to ensure the appropriate environmental information is provided at the correct time. There must be constant interaction and feedback between the EIA team, project designers and the proponent in order to ensure that design/location changes can be implemented to avoid or minimize adverse environmental impacts.
- Projects should be screened using techniques such as:
  - Project categories (based on impact magnitude thresholds)

- Sensitive area criteria
- Preliminary or initial EIAs
- Combinations of these techniques

- EIAs must cover social, economic and biophysical environmental impacts to the maximum extent possible.
- EIAs must be implemented in a multi-disciplinary manner.
- Involvement of all stakeholders, including the general public, should occur throughout the EIA process.
- Public consultation is an increasingly important part of the EIA process.

2.4.3. EIA References of International Financing Institutions

The links provided below provide information about the EIA requirements of IFIs and development agencies. The list is restricted to the addresses of the organizations presently acting or planning to get involved as development partners of the ECOWAS Member States. The purpose of the list is to facilitate access to EIA requirements for lending institutions for West African power projects.

INTERNATIONAL FINANCING INSTITUTIONS		
Institution	**Website Address**	**EIA-related Content**
African Development Bank	http://www.afdb.org	– Environmental Assessment Guidelines, 1992. – Environmental Sectoral Policy Guidelines for the Industrial Sector, 1995. – Guidelines on Involuntary Displacement and Resettlement in Development Projects, 1995. – Environmental Assessment Guidelines: Energy, 1997.
European Commission	http://europa.eu.int http://admi.net/eur	– Directive 2003/35/CE of European Parliament and the Council of 26 May 2003 providing for public participation in respect of the drawing up of certain plans and programmes relating to the environment. – Decision 1600/2002/CE of European Parliament and the Council of 22 July 2002 establishing the sixth community action programme for environment. – Council Directive 97/11/CE of 3 March 1997 amending Directive 85/337/CEE on the assessment of the effects of certain public and private projects on the environment. – Council Directive 85/337/CEE of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment.

INTERNATIONAL FINANCING INSTITUTIONS		
Institution	**Website Address**	**EIA-related Content**
European Investment Bank	http://www.eib.org	– Environmental Statement, May 2004. – Environmental Report 2003. May 2004. – EIB Environmental Procedures. July 2002. – EIB and its Contribution to Sustainable Development. July 2002. – EIB Sustainable Development and Environment Documents, July 2002. – The EIB and the Environment: Objectives, Operations and Approach. EIB Information 2-2001, N° 108.
The World Bank Group	http://www.worldbank.org/html/extdr/thematic.htm	– Operational Policy 4.01: Environmental Assessment, 1999 – Operational Policy 4.01, Annex A: Definitions, 1999 – Operational Policy 4.01, Annex B: Content of an Environmental Assessment Report for a Category "A" Project, 1999 – Operational Policy 4.01, Annex C: Environmental Management Plan, 1999 – Bank Procedure 4.01: Environmental Assessment, 1999 – Bank Procedure 4.01, Annex A: Environmental Data Sheet for Projects in IBRD/IDA Lending Program, 1999 – Bank Procedure 4.01, Annex B: Application of EA to Dam and Reservoir Projects, 1999 – Bank Procedure 4.01, Annex C: Application of EA to Projects involving Pest Management: Environmental Assessment – Pollution Prevention and Abatement Handbook. 1998.

DEVELOPMENT AGENCIES		
Institution	**Website Address**	**EIA-related Content**
Department for Foreign International Development (DFID)	http://www.oda.org	– The Manual of Environmental Appraisal. 1996. – Social Development Handbook: A Guide to Social Issues in ODA Projects and Programmes. 1995.
Japanese International Cooperation Agency (JICA)	http://www.jica.co.jp	– Environmental Guidelines for Dam Construction Projects. 199.0 – Environmental Guidelines for Infrastructure Projects. Undated. – Environmental Guidelines on JICA Development Study for Power Plant Development Projects. – Environmental Guidelines for Infrastructure Projects (JR 93-121), 1993.
United States Agency for International Development (USAID)	http://www.usaid.org	– 22 CFR 216: Environmental Procedures. AID Handbook 3 (US Government Federal Register). 1980. – Major Functional Series 200: USAID Programme Assistance. ADS 204 Environmental Procedures. Undated.

2.4.4. The World Bank's Environmental Standards

Compliance with environmental standards is assured with reference to the existing national or international requirements. Benin, Burkina Faso, Ghana, Nigeria and Senegal have established specific environmental standards, the rest of the ECOWAS Member States most frequently utilise the World Bank standards. The World Bank's norms are also necessarily used when the Bank's funding is sought for a particular project.

The World Bank policy distinguishes between two different types of environmental norms:

- **Ambient standards** set maximum allowable levels of pollutants in the receiving medium – air, water and soil. Establishment of ambient standards implies having a clear idea about the desirable quality of environment in a given area (a country or a city) and the costs the society is willing to accept to achieve such quality.

- **Emissions standards** set maximum concentration of pollutants that may be given off by a mobile device (e.g., motor vehicles) or a localised point source (ex. thermal power plants or transformer stations).

In the ECOWAS region Senegal adopted similar approach for evaluation of the ambient air quality *(émission)* and restricting levels of atmospheric pollution *(immission)*.[2]

The ambient and emissions standards imposed by the World Bank with respect to air, noise and effluent discharge are referenced in Tables 2.1 to 2.5. These standards are fully applicable to the electricity sector activities. The quoted indicators can be found in the World Bank's "Pollution Prevention and Abatement Handbook", 1998.

Table 2.1: Norms of Ambient Air Condition at Installation Boundaries

Pollutant	Concentration	
	Annual Arithmetic Mean	Maximum 24-hour Average
Particulate matter	50 µ/m^3	70 µ/m^3
Nitrogen oxides	100 µ/m^3	150 µ/m^3
Sulphur dioxide	50 µ/m^3	125 µ/m^3

All of the maximum levels should be achieved for at least 95% of the time that the plant or unit is operating, calculated as a proportion of annual operating hours. Dilution of effluents and air emissions to achieve maximum values is not allowed.

[2] Cf. sub-section "Senegal" in Section 3 for detailed description.

Table 2.2: The World Bank Air Emissions Limits for General Application

(All values expressed as mg/Nm³ unless otherwise stated.)

Pollutant or Parameter	Limit
Particulate matter (PM)	50 for units ≥ 50 MW 100 for units < 50 MW
Nitrogen oxides as NO_2:	
- Coal fired	750 (260 ng/J)
- Oil fired	460 (130 ng/J)
- Gas fired	320 (86 ng/J)
Sulphur dioxide	Not to exceed 2,000

General applications refer to "concentrations of contaminants emitted from the stacks of significant sources with an equivalent heat input of more the 10 million British thermal units per hour (Btu/hr)", which includes electrical generating equipment.

Table 2.3: Effluent Discharge Requirements for Thermal Power: Miscellaneous Parameters

(Milligrams per litre except for pH and temperature)

Pollutant	Description	Concentration
pH	Measure of acidity/alkalinity	6-9
BOD_5	Biochemical oxygen demand as measured over 5 days	50
Cl	Total residual chlorine	0.2
COD	Chemical oxygen demand	250
N	Nitrogen	NH_3-: 10
O & G	Oil and grease	10
S^2-	Sulphide	1.0
TSS	Total suspended solids	50
Temperature Increase	Measured at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, 100 meters from the point of discharge is used.	≤ 3ºC

Table 2.4: Effluent Discharge Requirements for Thermal Power: Metals

(Milligrams per liter)

Pollutant	Description	Concentration
Cr	Chromium (total)	0.5
Cu	Copper	0.5
Fe	Iron	1.0
Zn	Zinc	1.0

Table 2.5: Noise Maximum Allowable Values

Receptor	Maximum Allowable L_{eq} (hourly) in dB (Schedule A)	
	Day	Night
	07:00 – 22:00	22:00 – 07:00
Residential Institutional Educational	55	45
Industrial Commercial	70	70

Noise measurements must be taken at noise receptors located outside the project area bounds. Project proponent should ensure that contractors use appropriate noise control devices and take measures to minimize noise levels.

3. EIA PROCEDURES IN THE ECOWAS MEMBER STATES

In most sub-Saharan countries the planning of environmental management activities began in response to a grave development crisis at the end of the 1960s. The crisis was characterised by accelerated degradation of natural resources and deterioration of living conditions, aggravated by strong demographic growth rates and galloping inflation.

However, West African countries enjoyed in general a period of rapid infrastructure expansion in 1970s. This created an increased pressure on environment that became evident in the 1980s. The natural resources suffered from accelerated degradation of land, silting of water streams and increased levels of various kinds of pollution. The positive effects of economic progress were significantly reduced due to a lack of accompanying environmental policies and programmes.

The costs of environmental degradation proved to be significant. In Ghana, the total annual losses in 1988 were estimated at Cedis 41.7 billion, representing 4% of national GDP. In Benin, annual cost of environmental degradation caused by economic development in 1988 was estimated between 3% and 5% of the GDP, that is FCFA 15 to 26 billion. In Mali, the cost of environmental degradation was considered to be between FCFA 115 to 196 billion in 1995. The total loss in terms of GDP was between 20.9% and 26.5%, i.e. twice as much as the country's external debt.

The history of socio-economic development in West African countries is replete with strategies and plans for pursuing sustainable development and environmental policies. Various strategies were elaborated as a response to escalating environmental degradation. These plans and strategies have progressively shifted from a sector approach to a global view of natural resources management and sustainable development.

Despite country-specific development strategies dictated by particular situations in individual countries, it has been recognised that a durable solution to the problems of environmental degradation could only be guaranteed through a strategic approach, based on regional solidarity and international cooperation.

The phenomenon of globalisation and the increasing risk of marginalisation of smaller economies have brought to life a strong political commitment to regional integration, which can help West African countries to find their place in the process of economic globalisation and regionalisation.

The 1992 United Nations Conference on Environment and Development (UNCED), popularly known as the Rio Earth Summit increased awareness of the need to integrate environmental concerns into all existing and future economic and sector policies to ensure that they protect and improve the environment and natural base on which the health and welfare of the people depends.

A worldwide programme, "Agenda 21", was adopted to provide a strategic and holistic approach to achieving sustainable development. The conference adopted major conventions on desertification, biological diversity, and climate change. These were subsequently adopted and ratified by all ECOWAS countries and constitute the appropriate framework and instruments for dealing with environmental issues.

This section describes the established (and in some cases planned) EIA procedures, norms and standards and associated statutory requirements in each ECOWAS Member States to date. The analysis is structured in the following order for each country:

1. National legal and regulatory framework
2. The EIA process
3. Implications for the electricity sector
4. List of national legal and regulatory references
5. Institutions to contact in a Member State.

Any omission from the above structure for an individual country can be attributed to the unavailability of information from that particular country at the time of writing of these Guidelines.

BENIN

I. Legal and Regulatory Framework

In Republic of Benin, the right to live in a clean environment is guaranteed to the citizens by article 27 of the country's **Constitution,** adopted on December 11, 1990. The article proclaims: "Every person has a right to a healthy, satisfactory and sustainable environment and a right to defend it. The State is responsible for protection of the environment".

In 1974, the country created the first organizations responsible for development of environmental protection activities and elaboration of public awareness measures. There are three distinctive periods of evolution of national awareness with respect to environmental issues: the independence period (1960-1972), the revolutionary period (1972-1990), and the democratic renewal (from 1990 to date). However, the government became progressively more environmentally conscious in the 1990s. By that time the annual cost of environmental degradation to the national economy was estimated between 3% and 5% of GDP or FCFA 15 to 26 billion.

In 1991 the Government of Benin decided to prepare an **Environmental Action Plan - EAP** *(Plan d'Action Environmental - PAE)*. The EAP is envisaged as an integral part of the overall country's development policy. The EAP was finalised in December 1992 and its adoption was followed up by implementation of individual affirmative actions.

Ministries of Rural Development, Health, Planning, Education, Transport, Mines and Hydraulics, and Justice have integrated environmental aspects in their respective action plans. Decree 92-17 dated January 28, 1992, created the **Ministry of Environment, Habitat and Urbanism** with specific responsibility for elaboration of legislative texts, enforcement of their application and regulatory supervision.

In order to better mobilise available competences and remove overlap in responsibilities of the various Ministries with respect to the actions defined in the EAP, it has been decided to revise the existing institutional framework. The **Benin Environmental Agency - BEA** *(l'Agence béninoise pour l'environnement - ABE)* was created as a result of this revision in February 1995. The Agency is in charge of implementation of the environmental policy, defined by the Government in the country's development plan. In particular, the BEA is responsible for carrying out environmental studies and audits, elaboration of relevant procedures and by-laws for environmental impact assessment studies as well as evaluation of those studies.

The **Law on Environment** *(Loi-cadre sur l'environnement)* was adopted in 1999. It defines the basis for the environmental national policy and conditions for its implementation. Several regulatory decrees were further adopted between February and August 2001.

In 2001, in order to ensure efficient working conditions for the Agency, a functional administrative entity called **Environmental Unit** (*Cellule environnementale*) was created in different ministries. These units assure interaction with the BEA and are responsible for integrating environmental concerns in the development policies, programmes and projects in their respective ministerial sector or the territory of their administrative divisions.

II. The EIA process

In Benin, environmental assessment is defined as a set of procedures used for elaboration, implementation and monitoring of the programmes, projects and activities in conformity with the established environmental standards. National environmental assessment includes three procedures:

1. Environmental impact assessment study
2. Public hearing and
3. Environmental audit

Environmental Impact Assessment Study

Article 87 of the Law on Environment defines an environmental impact study as a procedure that determines the impacts of a project or a programme on the environment. The EIA must include the following:

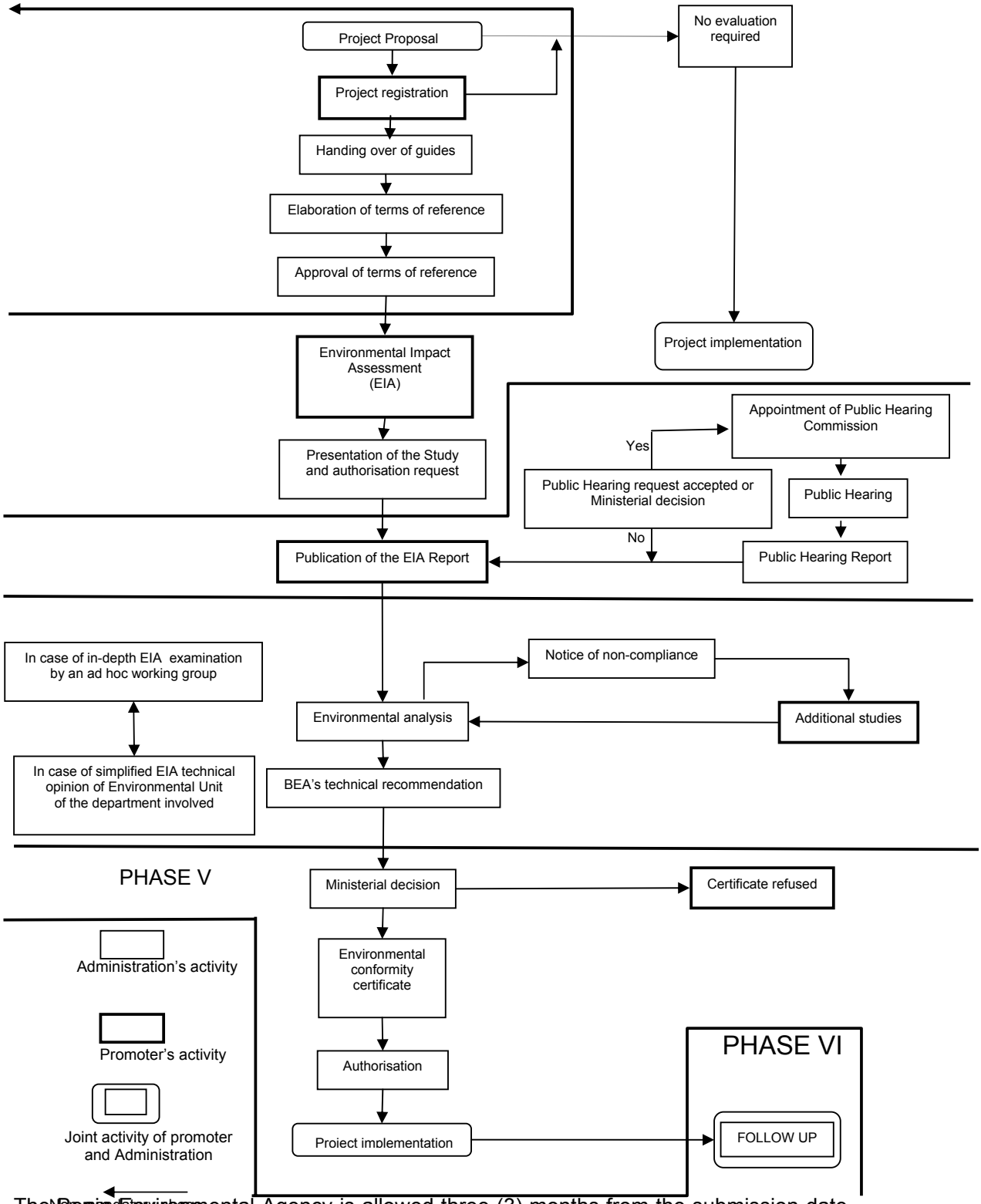
- Analysis of initial state of environment at the project site.
- Project activity's impact on the environment.
- Measures envisaged by project developer to eliminate, reduce or compensate the negative impacts as well as the associated cost before, during and after the project implementation.

Depending on the extent of their environmental impact, projects and programmes are subject either to a **simplified** or an **in-depth** environmental impact assessment. Simplified assessments are required for projects with limited impacts that could be easily prevented or limited with the help of an adequate mitigation plan. Projects with more significant effects as well as those within proximity to ecologically sensitive areas are subject to an in-depth EIA.

In Benin, project promoters are required to submit to the BEA for approval the **terms of reference** of the proposed study related to their projects. The EIA study must conform to the approved terms of reference. The **study** must describe expected impacts of the project on the environment and should include the following components:

1. Detailed description of the project, including plans, maps and figures necessary for understanding of the proposed project;
2. Detailed description of initial state of the site, its natural and socio-economic environment, with attention to its natural resources and other elements that are likely to be affected by the project;
3. Analysis of the project's predictable, direct, indirect and cumulative consequences for the environment;
4. Comparative analysis of alternative options, technical reasons and justification for choice of the project, as well as mitigation measures planned by the developer;
5. Measures envisaged by the project promoter to compensate, mitigate and, if possible, prevent negative impacts of the project on the environment;
6. Environmental management plan including monitoring and follow up activities during and after the project implementation phase.

Figure 3.1: Administrative Flow of the EIA Process in Benin



The Benin Environmental Agency is allowed three (3) months from the submission date to examine the EIA study. If the study is considered satisfactory, the Minister issues an

Environmental Conformity Certificate. The certificate is valid for a period of one year from the date of issue and expires if the project's physical implementation has not started in the specified period.

The project is considered approved from the environmental point of view if the administration has not replied to its promoter within six months after submission of the project's environmental assessment. The cost of the EIA study analysis is calculated as a function of the investment amount.

Figure 3.1 outlines the administrative flow of the EIA procedure in Benin.

Public Hearing

The public hearing procedure allows for public participation in the decision-making process about the project and is meant to facilitate government's decision. It can be initiated by an administrative authority or by any citizen interested in the project.

The procedure ensures the public's access to information and gives citizens an opportunity to ask relevant questions about the project and to express their opinion. The public hearing procedure is implemented by an ad hoc commission created by the Minister and named "The Environmental Public Hearing Commission" (*Commission d'audience publique sur l'environnement).*

Environmental Audit

Environmental audits are carried out to ensure conformity of the implemented projects to the established environmental control standards. Two types of audits are considered as mandatory:

- Internal audits are the responsibility of a company and are carried out by its own experts.
- External audits are initiated by the Minister upon recommendation of the Agency and carried out by a team of professional auditors and technical experts.

III. Implications for the Electricity Sector

The Benin Environmental Action Plan stresses that the use of solar, biogas and bio energy in the country so far remains experimental. On the positive side, Benin has important hydro electricity potential: there exist 44 potential sites at the border with Togo. Seven of them are planned for development over the next fifteen years.

The list of programmes for which environmental assessment is mandatory includes a number of projects relevant to the electricity sector development. These projects are described in Table 3.1.

Table 3.1: List of Electricity Sector Projects for which the EIA Is Mandatory

Type of project	Threshold	
	Simplified EIA	Complete EIA
Thermal generation plants, and other combustion installations for energy generation	< 10 MW	> 10 MW
Other industrial installations for energy and steam generation	Mandatory	N/A
Construction or re-location of a transmission line	Electric power transmission < 63 kV over > 10 km	Electric power transmission ≥ 63 kV over > 2 km
Construction or re-location of an electric power transformer station	< 63 kV	≥ 63 kV
Dam and hydro generation plants	< 10 MW	≥ 10 MW

In Benin there exist sector guides for EIA studies of the electrification projects. The guides describe main hardware components of such projects as well as explain methodology for identification of major environmental components affected by electricity sector development activities. They also describe in detail mitigation measures for such projects and explain principles of a post-construction environmental management plan.

There exist limits for emissions into atmosphere, ambient air quality, and level of noise coming from industrial installations, which can be relevant to the operation of electrical installations. The limit values are shown in the tables that follow.

Table 3.2: Norms of Emission into Atmosphere for Fixed Sources

Type of establishment	Parameter	Emission Limit Criteria
Combustion installation using hydrocarbons as fuel	Particles	90 mg/MJ
	Nitrogen oxides (NO_x)	325 ppm

Table 3.3: Norms of Ambient Air Quality in Benin

Pollutant	Measurement Period	Mean value
Ozone (O_3)	Average over 8 hours	0,08 ppm
Carbon monoxide (CO)	Average over 1 hour Average over 8 hours	40 mg/m^3 10 mg/m^3
Sulphur dioxide (SO_2)	Average over 1 hour Average over 24 hours Annual average	1300 µg/m^3 200 µg/m^3 80 µg/m^3
Particles in suspension (< 10 microns)	Average over 24 hours Annual average	230 µg/m^3 50 µg/m^3
Nitrogen dioxide (NO_2)	Average over 24 hours Annual average	150 µg/m^3 100 µg/m^3
Lead (Pb)	Annual average	2 µg/m^3

Table 3.4: Noise Level Norms on the Benin Territory in Decibels (dB)

Time period	Class 1 Inhabited Area	Class 2 Commercial Area	Class 3 Industrial Area
6 am to 1 pm	50	55	70
1 pm to 3 pm	45	50	70
3 pm to 10 pm	50	55	70
10 pm to 6 am	45	50	70

The above noise levels are measured outside the perimeter of the installations emitting noise. Electric power transmission lines are considered as one of the sources of noise.

Communauté Electrique du Bénin (CEB), a power transmission company owned jointly with Togo, uses the above norms for its high voltage transmission project interconnecting North of Togo and North of Benin.

In September 2003, **Société Béninoise de l'Eau and de l'Electricité (SBEE)**, the national electricity distributor[3], appointed its representative to the Environmental Unit in the Ministry of Mines, Energy and Hydraulics. This person is responsible for integrating environmental aspects in the company's development activities.

IV. Benin Legal References

1. Décret N° 95-7 du 20 février 1995 portant création, attribution, organisation et fonctionnement de l'Agence Béninoise pour l'Environnement.
2. Décret N° 2001-093 du 20 février 2001 fixant les conditions de l'élaboration de l'audit environnemental en République du Bénin.
3. Décret N° 2001-095 du 20 février 2001 portant création, attribution, organisation et fonctionnement des cellules environnementales en République du Bénin.
4. Décret N° 2001-109 du 4 avril 2001 fixant les normes de qualité des eaux résiduaires en République du Bénin.
5. Décret N° 2001-110 du 4 avril 2001 fixant les normes de qualité de l'air en République du Bénin.
6. Décret N° 2001-190 du 19 juin 2001 portant l'organisation de l'audience publique en République du Bénin.
7. Décret N° 2001-235 du 21 juillet 2001 portant organisation de la procédure d'étude d'impact sur l'environnement.
8. Décret N° 2001-294 du 8 août 2001 portant réglementation du bruit en République du Bénin.
9. Loi N° 98-030 du 12 février 1999 portant loi-cadre sur l'environnement en République du Bénin.
10. Guide général de réalisation d'une étude d'impact sur l'environnement, Agence Béninoise pour l'Environnement. Cotonou, février 2001.
11. Guide sectoriel d'étude d'impact sur l'environnement des projets de centrales hydroélectriques. Agence Béninoise pour l'Environnement.
12. Guide sectoriel d'étude d'impact sur l'environnement des projets d'électrification. Agence Béninoise pour l'Environnement.
13. Plan d'Action Environnemental. Cotonou, novembre 2001.

[3] A project is underway to create separate companies for electricity and water activities.

V. Institutions to Contact in Benin

Ministère de l'Environnement, de l'Habitat et de l'Urbanisme

Direction de l'Environnement

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Cotonou

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Fax: (+229) 31 50 81

Ministère de l'Environnement, de l'Habitat et de l'Urbanisme

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BURKINA FASO

I. Legal and Regulatory Framework

In the Republic of Burkina Faso, the basic principles for national environmental management are written in the **Constitution**, which states, "The sovereign people of Burkina Faso are conscious of absolute necessity to protect the environment." Its article 29 further states, "The right to a healthy environment is recognised. Protection of the environment is everybody's duty."

The **National Environmental Action Plan - NEAP** (*Plan d'Action National pour l'Environnement - PANE)* was prepared in 1991 and revised in 1994. It defines national policy in the environmental arena and serves as a reference for action planning while taking into account the current status and Burkina's different engagements in this field.

Environmental management regulation is constituted by a number of legislative texts. However, the practical implementation of these documents has been inefficient thus far. Creation of the **National Council for Environmental Management** (*Conseil National pour la Gestion de l'Environnement - CONAGESE)* in 1998 did not help to solve the problem even though the Council's work implied involvement of different ministerial departments and institutions.

Institutional restructuring is in progress to create a new administrative institution capable of consolidating and coordinating efforts from different institutions. The new institution will replace *CONAGESE* to be in charge of promoting environmentally friendly behaviour both in the public and private sector, and supporting the Government to facilitate efficient integration of environmental concerns in sector-specific development policies.

The new institution, named **National Council for Environment and Sustainable Development - NCESD** *(Conseil National pour l'Environnement et le Développement Durable - CONEDD)* will wield a more significant political power permitting it to initiate negotiations with ministerial departments for inclusion of environmental concerns in different sectors' development plans. Decree 2001-542 dated November 27, 2002 states that "the NCESD is responsible for promoting policy and legislation for environment and sustainable development; its mission is to facilitate efficient integration of fundamental principles of environmental management in the national and sector development policies with the view of promoting sustainable development." (Article 2)

The **Environmental Plan for Sustainable Development** (*Plan d'environnement pour le développement durable - PEDD)* will soon replace the **NEAP**. This new document will define the main activities and principles for all economic sectors with the view of creating acceptable living conditions. It will determine the national development strategy while taking into account the need for protection of the environment.

II. The EIA Process

In Burkina Faso, the national **Environmental Code** (Law 005/97/ADP dated 30 January 1997) and a number of application decrees adopted in 2001 define the environmental impact assessment process. The Code establishes the fundamental principles for environment protection and improvement of living conditions in Burkina Faso (Article 1).

The Code divides dangerous and polluting establishments into three classes:

The 1st class	Includes the establishments that, due to their nature, must be located away from inhabited zones;
The 2nd class	Includes the establishments for which it might not be strictly necessary to be located away from inhabited zones. However, their exploitation can be authorised only on a condition that necessary measures have been taken to mitigate the dangers and nuisances they create;
The 3rd class	Includes the establishments that, though not representing serious handicaps for surrounding environment, for public health or security, are nevertheless required to conform to requirements imposed for this type of establishments.

Decree 2001-342 defines the administrative process for the classified establishments relative to "the scope, contents and procedure of the environmental study and notice." The document introduces three categories of activities likely to have significant direct and indirect impacts on environment:

Category A:	Activities for which an EIA study is mandatory.
Category B:	Activities for which an environmental impact notice is mandatory.
Category C:	Activities that require neither an EIA study nor an environmental impact notice.

The **environmental impact study** is defined as an analytical study carried out in order to identify and evaluate environmental effects of a development project or programme.

The **environmental impact notice** is a simplified environmental impact assessment study. However, it must conform to the same requirements as the environmental impact study and address the issues that would allow for a full appraisal of a development project's impact on the environment.

Prior to the beginning of an EIA study, promoters are required to elaborate and submit the draft **terms of reference** for the scoping of the proposed study to the minister for environment and the minister in charge of the activity sector. These draft term of reference must include:

- A summary description of avant-project or pre-feasibility study;
- A description of environment (biophysical and human) of the project with analysis of interrelations between its different components;
- A clear definition of the study limits with respect to what will be included and excluded out of its scope;
- A prioritised list of potential impacts to be produced by the project;
- A public consultation plan.

Within fourteen working days from the date of submission of the terms of reference the environment minister will call together a meeting for the scoping of the study based on the terms of reference provided by the promoter.

During **the scoping phase**, the promoter shall use all appropriate communication means to inform local administrative authorities and the affected population about the intention to carry out an environmental impact assessment. The scoping aims to identify environmental components that could be affected by the project and, thus, are likely to cause public, professional or legal concern. It also aims to verify whether all the requirements for public information and participation have been clearly outlined.

The environmental impact study must include the following elements:

1. Analysis of initial state of the site and its environment, namely taking into account natural resources, atmosphere, agricultural, pastoral and recreational areas, cultural sites, and socio-economic infrastructure.
2. Description of the project and its activities, installations and works to be realised, justification of the chosen techniques and production methods as well as of its location.
3. Analysis of negative and positive, direct and indirect impacts on the site and its environment, taking into account natural resources, atmosphere, agricultural, pastoral and recreational areas, cultural sites, wood and water resources likely to be affected by the works and installations.
4. Description of the risks to the environment of a neighbour state as a result of planned activities (if appropriate).
5. Description of insufficiencies and uncertainties in the data collected during the data acquisition phase.
6. Necessary measures planned or not by the promoter in order to eliminate, reduce and compensate damaging consequences of the project on the environment as well as estimate of associated costs.
7. Non-technical summary of the above sections to be used for public communication and decision-making purposes.

The measures mentioned in item 6 above constitute an **environmental management plan – EMP** *(plan de gestion environnemental - PGE)*. The EMP is a set of actions that the promoter utilises to eliminate, reduce and compensate negative direct and indirect impacts on the environment, and to reinforce or enhance positive impacts. In particular, the environmental management plan must include:

- Precise definition of measures planned by the promoter;
- Quantitative data with respect to damage and rate of emissions into the surrounding environment;
- Plan implementation schedule;
- Estimated cost to implement the planned measures;
- Quantitative data with respect to expected results in terms of pollution rates or nuisance limits compared to legal norms and practices admissible in similar cases.

The **EIA report** is a document summarising the study results. It enables the:

- Promoter to design, plan and implement a development project or a programme that would minimize negative environmental impacts and maximize benefits in terms of cost and efficiency;
- Authorities to make an informed authorisation decision;
- Public to better understand the development project or programme and its impact on the environment and the affected population.

The Minister of Environment is allowed ten working days from the date of the EIA report or environmental impact notice submission to examine the EIA study and communicate his/her opinion on the project viability.

III. Implications for the Electricity Sector

In Burkina Faso, electric installations, dams and other water works are subject to an EIA study (Category A) or an EIA notice (Category B) as shown in table below:

Table 3.5: Electricity, Dams and Water Works Projects Classification in Burkina Faso

Activity Sector	Category A	Category B	Category C
ENERGY	- Energy transmission and distribution: voltage ≥ 225 kV; - Thermal plants with capacity ≥ 500 kW; - Nuclear plants; - Gas and hydrocarbons storage sites	- Energy transmission and distribution: voltage < 225 kV - Renewable energy installations - Equipment installation and modernisation works	- Maintenance and major refurbishment works
WATER	Large dams and water works of height ≥ 10 m	Small dams and water works (dam height between 3 and 10 m)	Small dams and water works (dam height below 3 m)

Republic of Burkina Faso has national norms for ambient air and pollutant emissions into atmosphere that are relevant for operation of electrical installations. These norms are illustrated in the tables that follow.

Table 3.6: Norms of Ambient Air Quality in Burkina Faso.

Pollutant	Limit Values	Measurement Period
Carbon monoxide (CO)	30 µg/m^3	Average over 1 hour
Sulphur dioxide (SO_2)	200 to 300 µg/m^3	Average over 1 hour
Nitrogen dioxide (NO_2)	170 µg/m^3 100 µg/m^3	Average over 1 hour Average over 1 hour
Particles	200 to 300 µg/m^3	Average over 24 hours
Lead (Pb)	2 µg/m^3	Annual average
Ozone (O_3)	150 to 200 µg/m^3	Average over 1 hour

Table 3.7: Norms of Emissions for Fixed Installations in Burkina Faso

Type of establishment	Parameters	Limit Values
Combustion installation (energy generation with capacity equal or superior to 3 MW)	Particles	90 mg/MJ
	Nitrogen oxides (NO_x)	330 ppm

SONABEL, the national electric utility, adopted its environmental policy on the 31st of May 2002. The policy represents the company's environmental commitment and establishes principles for rational resources utilisation to promote sustainable development. According to the policy, SONABEL aims to become a leader in the field of environmental management and develops environmentally friendly projects favourably accepted by local communities.

In order to improve its environmental performance, SONABEL is committed to:

- Integrate environmental concerns in the decisional process at all stages of the life cycle of its activities, projects and installations in order to achieve recognised environmental standards and to prevent pollution, manage impacts at the source, mitigate negative and maximize positive impacts.
- Implement a system of information, education and communication in the area of environmental management.
- Adopt a transparent attitude through involving local communities in environmental assessments of the company's activities and projects.
- Sensitise the company's commercial partners and suppliers with respect to the need for responsible environmental management of their activities, products and services.

In order to facilitate implement of its environmental policy SONABEL developed an **Environmental Management System – EMS** *(Système de Gestion Environnementale - SGE)*. The EMS is conceived as an integral part of the company's management system. The system concerns - and will gradually include – all the SONABEL's activities at various levels - generation, transmission, distribution as well as corporate governance.

The EMS can be viewed as a continuous process of improving SONABEL's environmental performance. Results of activities carried out are evaluated, reviewed and corrected on a yearly basis. New environmental objectives and targets are set on a regular basis in order to gradually improve the company's environmental performance.

The environmental management system was developed as a result of detailed analysis of environmental issues stemming from SONABEL's existing and planned activities, obligations and responsibilities. Such analysis has been carried out in a number of analytical reports containing recommendations regarding environmental status of several companies' business units.

The main activities performed within the framework of the EMS are characterised as a continuous cycle of activities. Environmental management process includes the following aspects:

- Knowledge of the state of environment
- Analysis of possible solutions for amelioration of the existing conditions
- Choice of priorities, objectives and targets
- Preparation of action plans and identification of technical experts in charge of them
- Evaluation of environmental action plan implementation progress
- Description of enhancements and modifications to the EMS

The EMS cycle lasts one year. However, this cycle can be shorter for certain components. It is important to note that each cycle must include elements of environmental performance improvement relative to realisation of specific activities. At SONABEL such annual cycle starts with approval of an annual budget in January and finishes in December of the same year as illustrated in Figure 3.2.

SONABEL's Environmental Service is in charge of environmental protection activities. Apart from the Service chief, the unit has two experts and an assistant. It also relies on advice of two short-term local consultants. In addition, twenty (20) focal points for environmental issues were appointed in the regions and at major company's installations. The environmental correspondents are responsible for sensitising the company's employees with respect to the environmental management issues both centrally and locally.

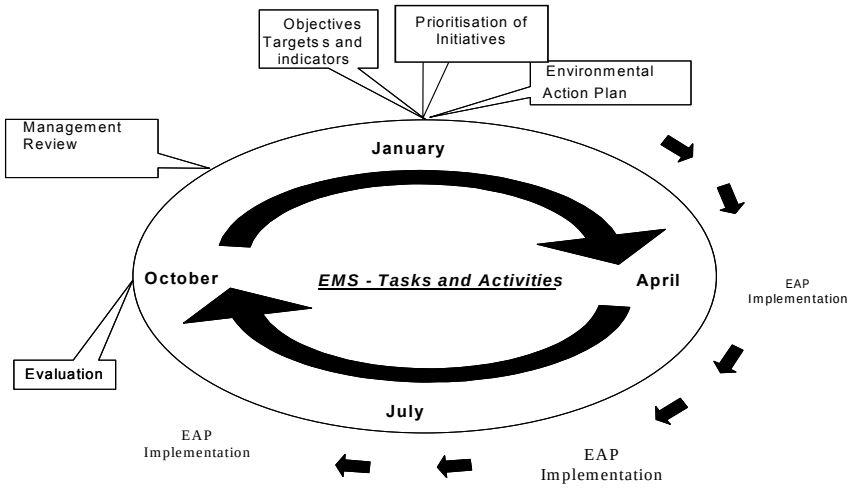

Figure 3.2: Normal Cycle of Environmental Activities at SONABEL

IV. Burkina Faso Legal References

1. Décret N^{o} 98-322 du 28 juillet 1998 relatif aux conditions d'ouverture et fonctionnement des établissements dangereux, insalubres et incommodes.
2. Décret N^{o} 2001-185 du 07 mai 2001 relatif aux normes de rejets de polluants dans l'air, l'eau et le sol.
3. Décret N^{o} 2001-342 du 30 juillet 2001 portant champ d'application, contenu et procédure de l'étude et de la notice d'impact sur l'environnement.
4. Décret No 2001-542 du 27 novembre 2002 portant attributions, organisation et fonctionnement du Conseil National pour l'Environnement et le Développement Durable (CONEDD).
5. Loi N^{o} 005/97/ADP du 30 janvier 1997 portant code de l'environnement qui vise à établir les principes fondamentaux destinés à préserver l'environnement et à améliorer le cadre de vie au Burkina Faso.
6. Plan d'environnement pour le développement durable (PEDD) du Burkina Faso. Rapport provisoire. Août 2002.
7. Projet de décret portant conditions de réalisation de l'audit environnemental.
8. Projet de décret portant cahier des charges précisant les conditions de collecte, de transport, de stockage, de recyclage, de traitement et d'élimination des déchets industriels et assimilés et les conditions d'hygiène et de sécurité.
9. Projet de décret portant réglementation des émissions dans l'atmosphère, de fumées, suies, poussières ou gaz toxiques, corrosifs, odorants ou radioactif.
10. Rapport sur l'état de l'environnement au Burkina Faso. SP/CONAGESE - 1ère édition. Mars 2002.

V. Institutions to Contact in Burkina Faso

National Council for Environment and Sustainable Development (NCESD)
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CAPE VERDE

I. Legal and Regulatory Framework

In the Republic of Cape Verde, the foundations of environment protection policy were laid down in its **Constitution**, adopted in 1975 and revised in 1999. Its article 7 accords to the State responsibility for protection of "the landscape, natural resources and environment as well as national historic, cultural and artistic heritage," and article 76 states that "every citizen has the right to healthy and ecologically clean environment and the right to preserve and protect it."

Environmental Law N^{o} 86/IV/93, adopted on 26 June 1993, laid down fundamental principles of the national environmental policy. The law postulates that environmental policy must ensure optimisation and rational use of natural resources, both qualitatively and quantitatively, to ensure a basis for sustainable development.

The **National Environmental Action Plan** *(Plano Nacional de Acção o Ambiente – PANA)* was first established with Dutch assistance in 1994. Presently, the Plan is under revision and PANA II is scheduled to be finalised in 2004. It consists of two parts: the first one detailing national environmental policy and the second one elaborating action plans for each of the country's 17 municipalities.

The **National Commission for Environment** with its permanent executive secretariat, integrating representatives of civic society and non-government organizations, was created with the responsibility for coordinating public and private activities related to the environment. Presided by the Prime Minister, the Commission was supposed to define policies and strategies for implementation of the Environmental Law as well as elaborate directives for regional and international cooperation in the environmental field. Unfortunately, the Commission was not able to fulfil its obligations correctly.

The **Ministry of Environment, Agriculture and Fisheries** *(Ministério de Ambiente, Agricultura e Pescas)* of Cape Verde is the main administrative authority responsible for management of environmental issues. A recently revised administrative structure of the Ministry of Environment provides for the creation of a new institution to replace the National Environmental Commission. Within the Ministry, the General Directorate of Environment is in charge of implementation of the national environmental policies, and, in particular, evaluation of EIA studies.

II. The EIA Process

In 1997, in its decree N^{o} 14/97, the Government made an attempt at establishing national regulatory framework for EIA process. The decree stated that public and private projects were to comply with environmental norms and introduced the principles of projects classification and licensing, public participation and others. Unfortunately, these provisions were not put into practice.

Seven years later, benefiting from experience acquired in the meanwhile, the General Directorate of Environment decided to elaborate a new regulatory set-up, under the name of "The New Regime for Evaluation of EIA Studies". The draft version of the document incorporates 41 articles and introduces a number of innovations. It sets fundamental objectives, describes composition and administrative attributions of EIA authorities, and defines in detail the EIA process.

III. Implications for the Electricity Sector

The Republic of Cape Verde is an archipelago consisting of 10 islands and 8 islets in the Atlantic Ocean approximately 500 km off the coast of West Africa. Electricity in the country is provided by a number of suppliers.

The largest single utility is the state-owned **Empresa de Electricidade e Agua – Electra, s.a.**, created in 1982. Electra supplies electricity to the islands of S. Vicente, Boavista and Sal. On the island of Santiago, Electra supplies electricity only to the capital City of Praia. In other districts of the various islands, electricity is supplied by smaller municipal utilities.

The installed generation capacity of all thermal plants in Cape Verde is 43.5 MW. The installed capacity of wind turbines is 2.82 MW. The electricity generated at the thermal (mostly diesel fired) power plants and at the windmills is distributed through 40 independent medium voltage distribution networks. There is no transmission grid interconnecting these distribution networks.

An independent environmental assessment conducted in 1998 revealed that negative impacts of the Cape Verde electricity sector activities are stemming mostly from activities of its power generation facilities. Thus, the main negative impacts from the **thermal electricity generation** are:

- High level of air pollution from operation of existing power plant engines. The impacts are greatest in major cities, where large power plants are situated in the centre. This is partly explained by the fact that certain facilities do not have stacks high enough to avoid building wake effect and resulting plume downwash.

- High level of noise from operation of existing power plant engines. Noise is a problem both on-site and off-site at most of the facilities. The noise from certain facilities affects both the surrounding community and workers.

- Risk of soil and groundwater contamination from discharge of untreated drainage water, leaking oil storage tanks, fuel pipes or faulty oil handling procedures. Fuel storage and handling needs improvement at all the facilities, especially the municipal facilities, which have the worst fuel handling systems and the most spillage.

- The impacts associated with the existing thermal power generation are compounded by the unsuitable location of many power plants in the centres of the cities. Furthermore, as there are no zoning requirements restricting utility installations to industrial areas, residential and commercial development keeps encroaching on the facilities' territory.

The Cape Verde **wind farms** have mostly positive effects on the environment, including:

- Reduction in diesel fuel consumption and associated atmospheric emissions

- Reduced risk of oil spills

- Increased production of electricity

Potential negative environmental effects of wind farms have not been observed on a significant scale. Therefore, little is known about:

- Changes in land use
- Conflict with other forms of land use (quarrying, tourism and industrial development)
- Effect on birds
- Effect on flora (no major impacts with good civil design and construction practices)
- Effect on telecommunications
- Effect on air traffic control
- Landscape and visual effects
- Noise
- Health and safety (no high or unusual risks, given normal wind farm construction and operation practice)

At **Electra – s.a.** a new management structure has been created in an attempt to improve the company's financial, technical and environmental performance. The company's new Executive Board consists of four Departments including the Department of Quality and Environment in charge of the following corporate tasks:

- Rational use of technical and human resources
- Studies relative to the company's environmental policies and environmental management
- Potable water quality control
- Wastewater and effluents control

Electrification projects are not explicitly mentioned in any list of the projects subject to an EIA, although one line of the draft list annexed to the New Regime under elaboration mentions "thermal power stations and other combustions installations". Thus, at the current time, there are no existing environmental regulations that electrical installations must meet. Operators are not required to monitor and quantify their pollutant emission levels. In most cases, design, location, and equipment specifications for existing installations do not consider the environmental impacts of their operation and location on Cape Verde citizens.

IV. Cape Verde Legal References

1. Constituição da República Cabo Verde (CRCV), Revisão de 1999.
2. Decreto-Lei N^{o} 5/2003, de 31 de Marco. Define o sistema nacional de protecção do ar.
3. Decreto-Lei N^{o} 3/2003, de 24 de Fevereiro. Establence o regime juridico dos espaços naturais, paisagens, monumentos e lugares que ... merecem tratamento especial.
4. Decreto-Lei N^{o} 8/2002, de 25 de Fevereiro. Aprova o diploma organico do Ministerio da agricultura e pescas.
5. Decreto-Legislativo N^{o} 14/97, de 1 de Julho. Desenvolve as bases do politico ambiente.
6. Decreto-Lei N^{o} 5/95, de 6 de Fevereiro. Define a composição, as competências e o functionamento do secretariado executivo para o ambiente.
7. Decreto N^{o} 82/87, de 1 de Agosto. Establece normas de garantia da qualidade dos recursos hídricos e de prevenção às doenças de base hídrica.
8. Lei N^{o} 137/IV/95, de 3 de Julho. Autorizando o governo a legislar sobre alguns crimes contra o ambiente e respectivas penas.
9. Lei N^{o} 134/IV/95, de 3 de Julho. Aprova os Estatutos dos Municípios.
10. Lei N^{o} 85/IV/93, de 16 de Julho. Bases do ordenamento do territorio nacional e o planeamento urbanistico.
11. Lei N^{o} 86/IV/93, de 26 de Julho. Define as bases da politica do ambiente.
12. Lei N^{o} 102/III/90, de 29 de Dezembro. Estabelence as bases do património cultural e natural.
13. Lei N^{o} 41/II/84, de 18 de Junho. Aprova o Código da Agua.
14. Novo regime de avaliação de impacte ambiental. 2003.
15. Plano energético nacional (PEN). Plano de política energética da república de Cabo Verde para o período 2003 -2012. Ano de Referência: 2000. Versão provisória Julho 2003.
16. Portaria N^{o} 1-F/91, de 25 de Janeiro. Establece um conjunto de regras a observar pelas empresas industriais que procedam ao transporte, armazenagem, manuseamento, tratamento e evacuação de produtos tóxicos ou perigosos.

V. Institutions to Contact in Cape Verde

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CÔTE D'IVOIRE

I. Legal and Regulatory Framework

In the Republic of Côte d'Ivoire, in accordance with the country's resolution to adopt the principles of sustainable development, the National Environmental Action Plan – NEAP ***(Plan National d'Action Environnemental - PNAE)*** was prepared in 1995 to evaluate the state of the environment and elaborate relevant development policies and actions. The PNAE became the first tool for integrated environmental management in Côte d'Ivoire. It identified the major environmental problems of the country and strategies for their resolution.

In order to implement the plan it was necessary to define institutional and legal framework for affirmative environmental action in Côte d'Ivoire. The Code of Environment was adopted in October 1996. Decree N° 96-894 of 08 November 1996 determined the rules and procedures for environmental assessment studies for development projects. National Environment Agency (**Agence Nationale de l'Environnement - ANDE**) was created by Decree N° 97-393 in July 1997 with a mission to ensure that environmental dimension is integrated in the development projects and programmes.

Institutions and organizations concerned with environmental impact assessments are the sector ministries (infrastructure, mines and energy etc), the Ministry of environment, public and private entities (expert agencies, promoters, NGOs, various associations and public representatives).

II. The EIA Process

The EIA administrative procedure in Côte d'Ivoire is presented in Figure 3.3.

The National Environmental Agency is responsible for EIA studies and, in particular, for the following tasks:

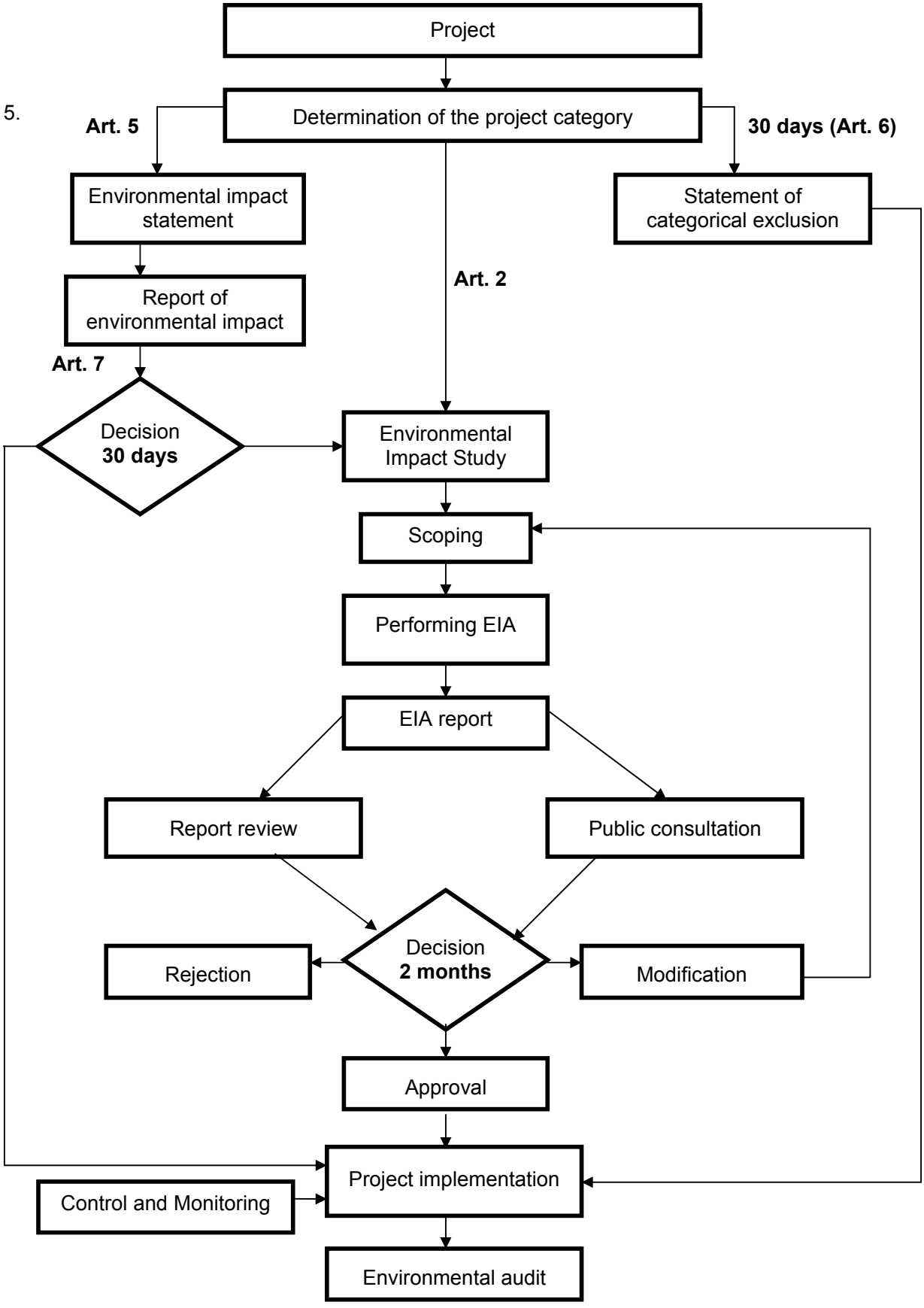
1. Technical assistance to various participating organizations (administration, NGOs and other parties).

2. Definition of terms of reference for EIA studies in coordination with the respective technical units, expert entities carrying out the studies, the promoter or their representative and the public.

3. Registering and evaluating the EIA studies for the purposes of issuing an approval or an authorisation, under the responsibility of the Minister for Environment.

4. Auditing and monitoring of measures recommended by an EIA.

Figure 3.3: The EIA administrative procedure in Côte d'Ivoire. (Established by the EIA Decree dated 08 November 1996)



Organization of public hearings in coordination with concerned administrations.

A public hearing helps to ensure active public participation in a project as well as its acceptance by the local population. It lasts 15 days in local communities where the project is planned for implementation. An administrator in charge is appointed and a file is opened in the register where entries are made to collect various observations. A communication meeting is organised during which the Ministry of Environment and the entity that has carried out the study explain the project and the different mitigation measures adopted in order to protect the population. At the end of the public hearing, the public administrator prepares a public hearing file for the project. Once this has been accomplished, the Ministry of Environment can approve the EIA.

6. Diffusion of information facilitating the appraisal of the nature and scope of the planned measures.

Selection of projects for an EIA is carried out using lists annexed to the Decree determining environmental protection rules and procedures. The lists define three categories of projects, regardless of their sector:

- Projects presenting a clear threat to the environment are listed in Annexe I and require a **full EIA**.
- Projects listed in Annexe II require an **environmental impact statement**, which is used to decide whether a complete EIA is necessary.
- Projects not listed in the two Annexes above, are categorically exempted. Such projects require a statement of exemption, which can be issued within 30 days.

However, an EIA can be imposed on a project that is not likely to have significant environmental effects if it is found in an environmentally vulnerable area (protected areas, natural reserves, wetlands and mangroves etc.)

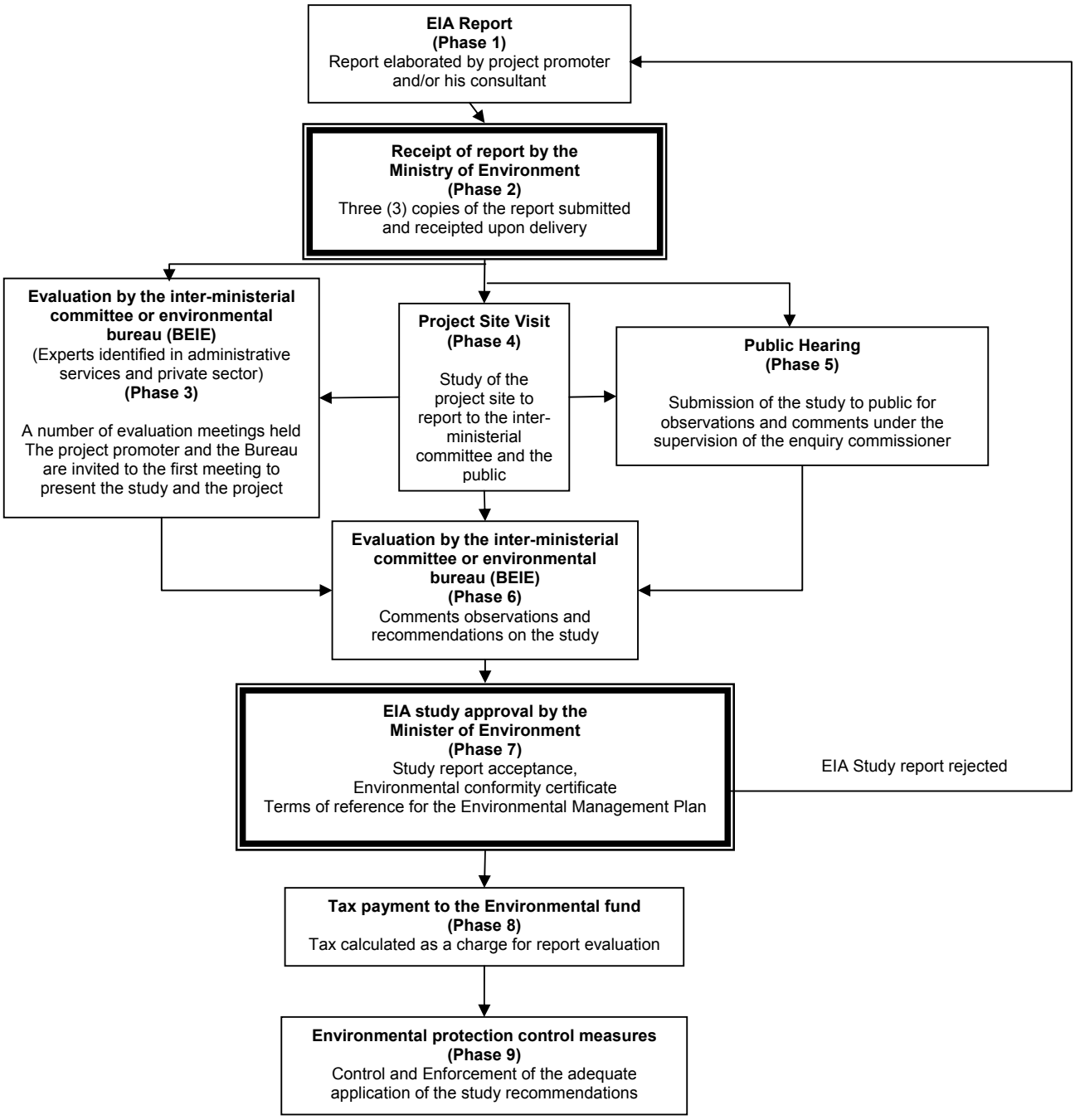
The procedure of analysis of the EIA study or statement reports includes nine phases graphically represented in Figure 3.4 that follows.

The 1996 EIA Decree imposes that an EIA shall include the following:

- A description of the proposed activity
- A description of the environment that is likely to be affected
- A list of products to be used, if applicable
- A description of the alternative solutions, as appropriate
- An evaluation of possible and potential, direct, indirect, cumulative long- and short-term effects of the proposed activity on the environment
- A description of identified mitigating measures with reference to the effects of the proposed activity and evaluation of such measures
- An indication of any data insufficiency and uncertainties encountered during the environmental data collection
- An indication of the risks for the environment of a neighbour state resulting from the proposed activity and of possible alternative solutions
- A brief executive summary reflecting the information given in the previous sections

- A description of a system for control and monitoring on a regular basis of environmental indicators before (initial state) and during construction, as well as during operational phase, and, if necessary, after de-commissioning (site restoration or re-assigning)
- A financial estimate of the cost of the recommended measures designed to prevent, reduce or compensate the project's negative effects

Figure 3.4: Administrative Procedure for Analysis of the EIA studies or statements in Côte d'Ivoire



The phases illustrated in Figure 3.4 above can be grouped into three major stages:

1. Receipt of a study report by the Ministry of Environment. This phase groups together phases 1 and 2.
2. Evaluation of the report (phases 3, 4, 5 and 6). At this stage the evaluation process includes:
   - Technical analysis. This is carried out during an evaluation meeting with participation of specialists from technical units of ministries concerned by the study and other organizations in accordance with their field of expertise.
   - Social analysis. This is a submission of the report to a public hearing in order to collect comments and suggestions of the concerned population.

     Both evaluation methods are for all types of development projects. In practice, the Ministry of Environment submits a project to a public hearing procedure on a basis of its scope and complexity.

   - Project site visit. Such visits are necessary to better understand the sites' existing environment and appraise the adequacy of the EIA study contents.
3. Approval and setting up environmental control and monitoring process. This stage combines phases 7, 8 and 9.

An EIA study is carried out at a promoter's expense. Promoter is free to choose any independent consultant for its implementation. However, *participation of national experts is mandatory*. Depending on available resources, the required proportion of national and foreign consultants and experts is 2/3 for the national ones and 1/3 for the foreign ones.

The Ministry of Environment has two (2) months from the date of the study submission to communicate its decision with respect to the proposed project. A receipt is issued when the project document is submitted.

III. Implications for the Electricity Sector

Article 7 of Decree 96-894 defines different types of power generation projects in accordance with the energy source used, namely:

- Solar energy
- Biomass energy
- Wind energy
- Geothermal energy
- Hydroelectric energy
- Thermal energy
- Nuclear energy

In Côte d'Ivoire, the electric power projects for which a *full EIA is mandatory* include the following:

- Thermal plants and other combustion installations with high capacity
- Hydroelectric dams

The list of the energy projects for which an *environmental statement is mandatory* includes the following:

- Industrial installations for energy and steam generation (except those included above)
- Overhead energy transmission lines
- Installations for hydro electricity generation

The Ivorian competent authorities are currently working on an EIA sectoral methodology guide. This guide will include a section relative to the electricity sector.

Société d'Opération Ivoirienne d'Electricité (SOPIE) is responsible for expansion of the national grid and electricity generation capacity in Côte d'Ivoire. When preparing its projects documents, SOPIE follows the procedures imposed by the Bureau of Environmental Impact Studies. This is done for national projects as well as those concerning interconnection with foreign countries. **Compagnie Ivoirienne d'Electricité (CIE)**, which is operating the national distribution grid, uses environmental authorisations obtained by SOPIE to do maintenance work on the electrical lines.

IV. Côte d'Ivoire Legal References

1. Procédure d'évaluation des études d'impact et constant d'impact environnemental. Document d'information aux promoteurs. Bureau d'études d'impact environnemental - Abidjan, 31 mars 2003.

2. Décret N^{o} 97-393 du 09 juillet 1997 portant création et organisation d'un Etablissement publique à caractère administratif dénommé Agence Nationale de l'Environnement (ANDE).

3. Décret N^{o} 96-894 du 08 novembre 1996 déterminant les règles et procédures applicables aux études relatives à l'impact environnemental des projets de développement.
4. Loi N^{o} 96-766 du 03 octobre 1996 portant Code de l'Environnement.

V. Institutions to Contact in Côte d'Ivoire

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THE GAMBIA

I. Legal and Regulatory Framework

In May 1994, the Republic of Gambia adopted the **National Environment Management Act (NEMA)**, which became a legislative framework for environmental impact assessments in the country. The Act states: "the Gambian people have recognised the importance of sound environmental management in order to safeguard the health and well being of all persons living in Gambia."

NEMA created the **National Environment Management Council (NEMC)** chaired by the Head of State, the **National Environment Agency (NEA)**, in charge of implementation of the policies defined by NEMC, review and approval of environmental impact assessments submitted in accordance with NEMA or any other law, and the **Technical Advisory Committee**, consisting of fifteen members with expertise in the various fields of environmental management. In addition, there were established units for environmental planning at the local level in the City of Banjul, the Kanifing municipal area and each administrative division.

The **Gambia Environmental Action Plan (GEAP)** became the key instrument of national environmental planning. The Plan was first developed in 1992 and subsequently revised in Phase II for the period 2000 – 2004 following assessment and review of the initial implementation (Phase I).

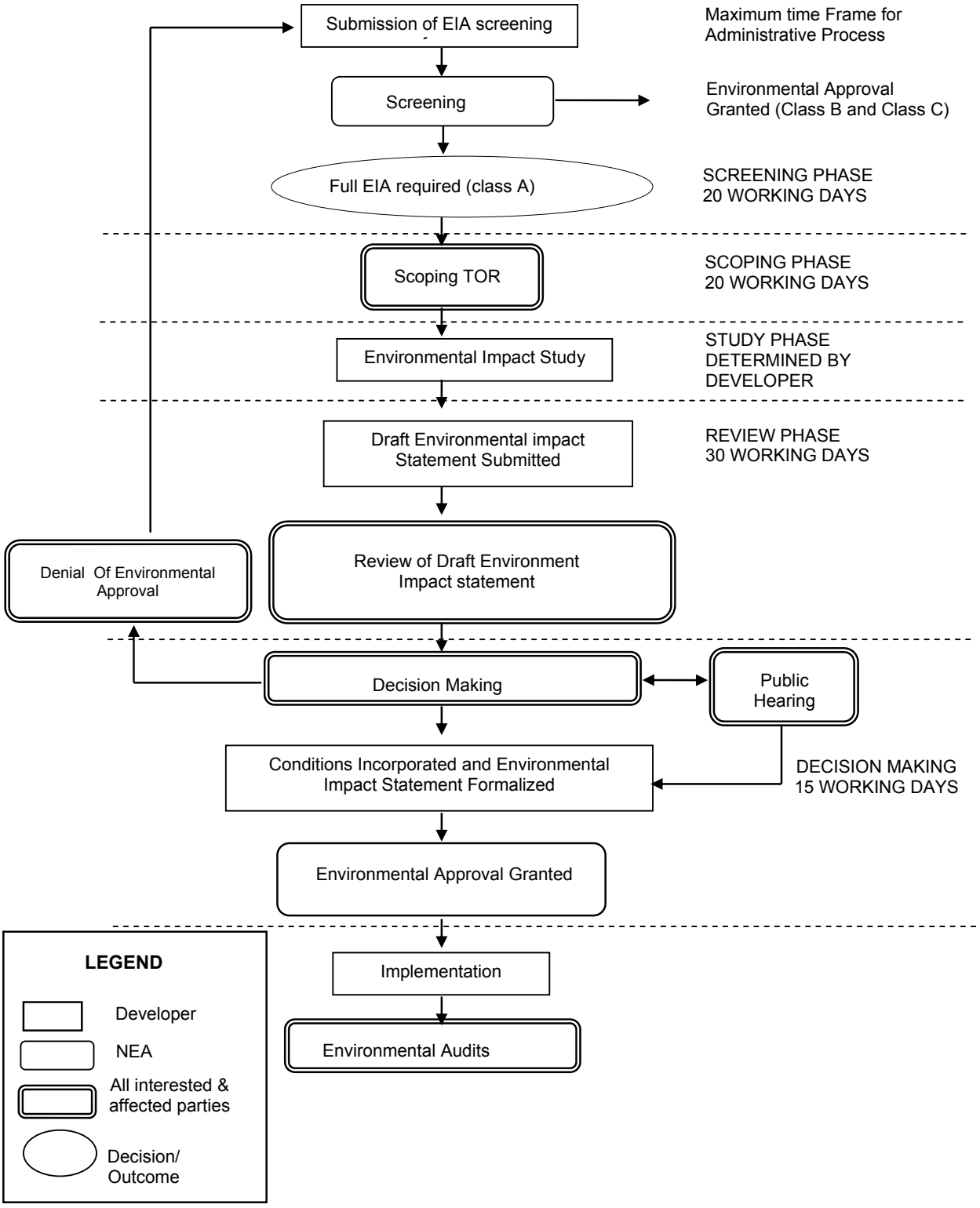
II. The EIA Process

In The Gambia, the environmental impact assessment is defined as "a formal process used to predict the environmental consequences of a proposed development project". The EIA Procedures of The Gambia further state that the process "requires identification of approaches to mitigate the negative impacts". The EIA procedures and regulations are responsibility of the National Environment Agency. They were defined by the NEMA and detailed in the Agency's guide "Environmental Impact Assessment Procedures" published in July 1999. The document describes the EIA operational procedure and includes associated forms and instructions in annex. The general overview of the EIA process administrative flow is presented in Figure 3.5.

The screening process is designed to determine the extent of EIA coverage for development projects. It is done with the aid of the EIA "Screening Forms" provided in annex and available at NEA and various state departments. Based on review of the information provided in the screening form, the Agency determines whether an environmental impact study needs to be conducted. All projects are classified in the following manner:

Class A:	Full Environmental Impact Assessment is required – In cases where there is sufficient reason to believe that the project will cause a significant negative impact on the environment. However, routine project types (projects that have been adequately assessed in the past) may be exempted from a full EIA.
Class B:	Additional information is necessary. This applies to cases where doubt remains as to the significance of potential effects on the environment. Further information is required to make a decision on classification.
Class C:	No full Environmental Impact Assessment is required.

Figure 3.5: The EIA Process Administrative Flow in The Gambia



In line with the transparent and consultative principle of the EIA process the developer is required, after the Agency has decided on a Class A environmental impact study, to inform the public, and invite them to make representation to the Executive Director on the proposed project. The Executive Director determines the most appropriate means of public notification in each case.

The process of initial screening shall not exceed twenty (20) days after the receipt of the completed Screening Form. In exceptional cases and where additional information has been requested, the length of the screening process may be extended. If this is the case, the developer will be notified in writing of the extenuating circumstances, and a revised timeframe would be established.

The EIA Scoping Process may begin once the Agency has determined that a full EIA is necessary. A scoping meeting is convened to review the project proposal and determine the areas that should be specifically addressed in the EIA as well as the depth of analysis necessary to accurately predict the magnitude of impacts and identify mitigating measures. The EIA Working Group is charged with determining the scope for each individual study. Resource persons and members of the affected communities may be invited to a scoping meeting. Invariably, the developer and his consultant shall be invited. The scoping meeting shall take place within two weeks after the end of the required public notification. Where it is necessary to extend this period, the Executive Director will inform the developer accordingly.

It is the responsibility of the EIA Working Group during scoping to prepare the **terms of reference** (TOR) of the study. The TOR should include:

I. Description of proposed project and associated activities (including technologies and processes to be used)

II. Identification of alternative approaches and sites considered

III. Identification of environmental issues or impacts to be considered

IV. Analysis of significance of impacts

V. Identification and selection of mitigating measures/project alternatives that should be considered in the environmental impact study

VI. Determination of appropriate methods of assessment (predictive methods and criteria for evaluation; depth of studies required for impact assessment)

VII. Identification of gaps in knowledge and uncertainties

VIII. Need for management and monitoring plans

IX. Agreement on further requirements for the environmental impact study

The approved terms of reference shall be delivered to the developer within twenty (20) days after the EIA Working Group meeting. The developer will be informed in the case of extraordinary delays. In the event that a period of 12 months expires before the study commences the developer may be required to re-submit the proposal through the scoping process.

It is recognised that the contents of each individual EIA study can vary based on the breadth and depth of analysis called for in the TOR. However, the procedure stipulates that some elements must feature in all studies. Such elements include:

I. Executive summary

II. Project description

III. Description of the environment
IV. Description of project impacts
V. Description of alternatives considered
VI. Assessment of legal implications of the impacts
VII. Description of expected benefits of the project
VIII. Description of methodology
IX. Evaluation of impacts
X. Mitigating measures
XI. Identification of information gaps
XII. Other: items and issues that were not covered in other sections
XIII. List of the study team members and others who participating in the preparation of the studies
XIV. List of references: persons contacted and bibliography

The study phase results in a **Draft Statement**. At this stage of the process, the Environmental Impact Statement is considered a draft because it represents the findings and views of the developer and not necessarily the opinions or findings of the Government. The developer shall submit copies of the Draft Statement to the members of the Working Group and to other persons and places specified by the Executive Director. All the recipients of the document and members of the public shall forward their comments to the NEA within 30 days after the developer has submitted them. A **Review Report** shall be prepared and discussed by the EIA Working Group. The appropriate decision shall be communicated to the developer within 15 days of the meeting. The entire review process may not exceed 90 days.

The EIA Working Group may request the developer to revise the Draft Statement to strengthen or highlight certain information that was determined to be lacking or may request additional mitigating measures or alternatives be sought or considered. If the Working Group finds the Statement sufficient, it will recommend environmental approval. A public hearing may be desirable where there is significant public opposition to a proposed project. In this event the NEMC will appoint a mediator.

An **Environmental Approval** may be granted with or without conditions. The Agency keeps a register of all Environmental Impact Statements for public scrutiny and reference.

III. Implications for the Electricity Sector

Annex 4 of the Environmental Impact Assessment Procedures classifies electrical infrastructure projects among those to be considered for environmental impact assessment, including:

(a) Electricity generation stations.
(b) Electrical transmission lines (high voltage).
(c) Electrical sub-stations.
(d) Pumped-storage schemes.

In March 1999, the NEA published the EIA Guidelines for seven different economy sectors. There exist, however, no guidelines specific to the electricity sector activities.

As in other power systems supplied by thermal generation units burning oil, the most negative environmental impact of **National Water and Electricity Company**'s **(NAWEC)** is created by its diesel engine installations producing heavily oil polluted wastewater and oily sludge.

Early in 2003, the company ordered an independent review of the environmental status of its Kotu Power Station. Based on assumption that 5% of the used fuel oil goes into sludge, it has been calculated that the station would produce about 2,000m^3 sludge per year. The review has found that the Kotu Power Station was causing large-scale environmental problems both off-site and on-site. The main off-site impacts have been identified as follows:

- The discharge of sludge into Kotu River polluting soil and water. It is estimated that NAWEC is currently contaminating Kotu River with 2-6 m^3 of liquid sludge every day.
- The possibility that an off-site flow of oily water contaminates nearby drinking water wells.
- The risk that considerable amounts of oily sludge leave the plant and pollute the downstream areas.

On-site impacts include:

- Widespread soil (and probably groundwater) contamination
- Fire hazard
- Employee health hazard (oil and oil fume contact, noise)
- Excessive sludge and solid oily waste production

In accordance with the review recommendations, NAWEC is planning to create an Environmental Management System (EMS) with an Environmental Manager in charge. Initially, environmental expert will be positioned within the electricity generation department to ensure turn-around of the environmental situation of the company's diesel units.

NAWEC prepares to adopt an environmental policy to ensure continued improvement of company's environmental performance. The policy makes it the long-term objective of NAWEC "to reach and stay in the front line in all matters related to the environment. NAWEC develops environmentally acceptable projects favourably welcomed by the Gambian society. The NAWEC management promotes and practices a health-orientated environmental management based on ISO 14001 norms with the principle of sustainable perspectives and continued improvements."

To implement the policy, the company developed an Environmental Action Plan targeting 13 objectives in such key areas as soil and water contamination with oil and sludge, training and raising awareness for environmental protection, and overall environmental performance improvement.

IV. Gambia Legal References

1. Environmental Impact Assessment Guidelines, Banjul, March 1999.
2. Environmental Impact Assessment Procedures, Banjul, July 1999.
3. The Gambia Environmental Action Plan (GEAP), 1992.
4. National Environment Management Act, 1994.

V. Institutions to Contact in Gambia

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GHANA

I. Legal and Regulatory Framework

In Ghana, environmental degradation became a concern of the Government in 1974, when the country created its own Environmental Protection Council (EPC), the first governing body in Africa to focus on issues of environmental management. An attempt has been made to estimate the costs imposed on Ghanaians and the economy by environmental degradation in such sectors as agriculture, forestry, hunting, industry and mining. Such costs proved to be significant: in 1988, the total annual loss was estimated at 41.7 billion Cedis, or equivalent to 4% of total GDP.

In March 1988, the Government of Ghana initiated a major effort to put environmental issues on the priority agenda. The exercise has culminated in the preparation of a strategy to address the key issues with respect to the protection of the environment and better management of renewable resources. The objective of what became known as the national **Environmental Action Plan (EAP)** was to define a set of policy actions, related investments, and institutional strengthening activities to make Ghana's development strategy environmentally more sustainable. A **National Environmental Policy** was developed to provide the broad framework for the implementation of the Action Plan.

Specifically, the policy provided for:

- Maintenance of ecosystems and ecological processes essential for the functioning of the biosphere
- Sound management of natural resources and environment
- Protection of humans, animals and plants and their habitats
- Guidance for healthy environmental practices in the national development effort
- Integration of environmental considerations in sector structural and socio-economic planning at all levels
- Common approach to regional and global environmental issues

The Environmental Protection Act defined environmental impact assessment as a method used to identify a project's probable impacts on the environment. It is carried out in order to influence project design and the choice of project alternatives. The Environmental Protection Council was charged with development of the EIA process and procedure and establishment of standards and guidelines relating to the pollution of air, water, land and other forms of environmental pollution.

The Council, however, lacked the mandate to ensure compliance and therefore needed to be reformed. The Ministry of Environment and Science was created in 1993 and a new authority – **Environmental Protection Agency (EPA)** came into existence with the enactment of the Environmental Protection Agency Act in 1994 (Act 490). EPA became an environmental programme implementer and an environmental regulatory authority. Today, the Agency employs 290 people and has regional and district offices.

II. The EIA Process

The Parliament passed **Environmental Assessment Regulations** for Ghana on the 18th of February 1999. The Regulations define EIA as "a planning and a decision making tool, applied in Ghana to proposed "undertakings" (i.e. any activity, project, structure, investment, plan, programme etc), the implementation or development of which may have a significant impact." EIA involves the gathering and analysis of all relevant information on a proposed undertakings to determine the likely consequences for the environment in a given area as well as what appropriate mitigations or alternatives must be considered to ensure environmentally sound and sustainable implementation or development.

The Regulations define two categories of projects, which require either registration and environmental permit (Schedule 1) or an environmental impact assessment (Schedule 2). A special provision on existing undertakings in the Regulations requires from people responsible for "any undertaking in existence on the date of the coming into force of the Regulations to seek registration and obtain an environmental permit if such undertakings are likely to have adverse effect on the environment or public health."

From the proponents' point of view, the EIA process in Ghana is split into the following main phases:

1. Registration and application for environmental permit
2. Scoping for EIA, which results in terms of reference for the EIA
3. The actual EIA, which results in environmental assessment statement

The EIA procedural cycle in Ghana is described below. The administrative flow of the process is shown in Figure 3.6.

The environmental permit application is mandatory in case "the undertakings specified in Schedule 1 or any undertaking to which a matter in the Schedule relates." The application is screened by the EPA and should contain the following information about the project:

(a) The location, size and likely output of the undertaking

(b) The technology intended to be used

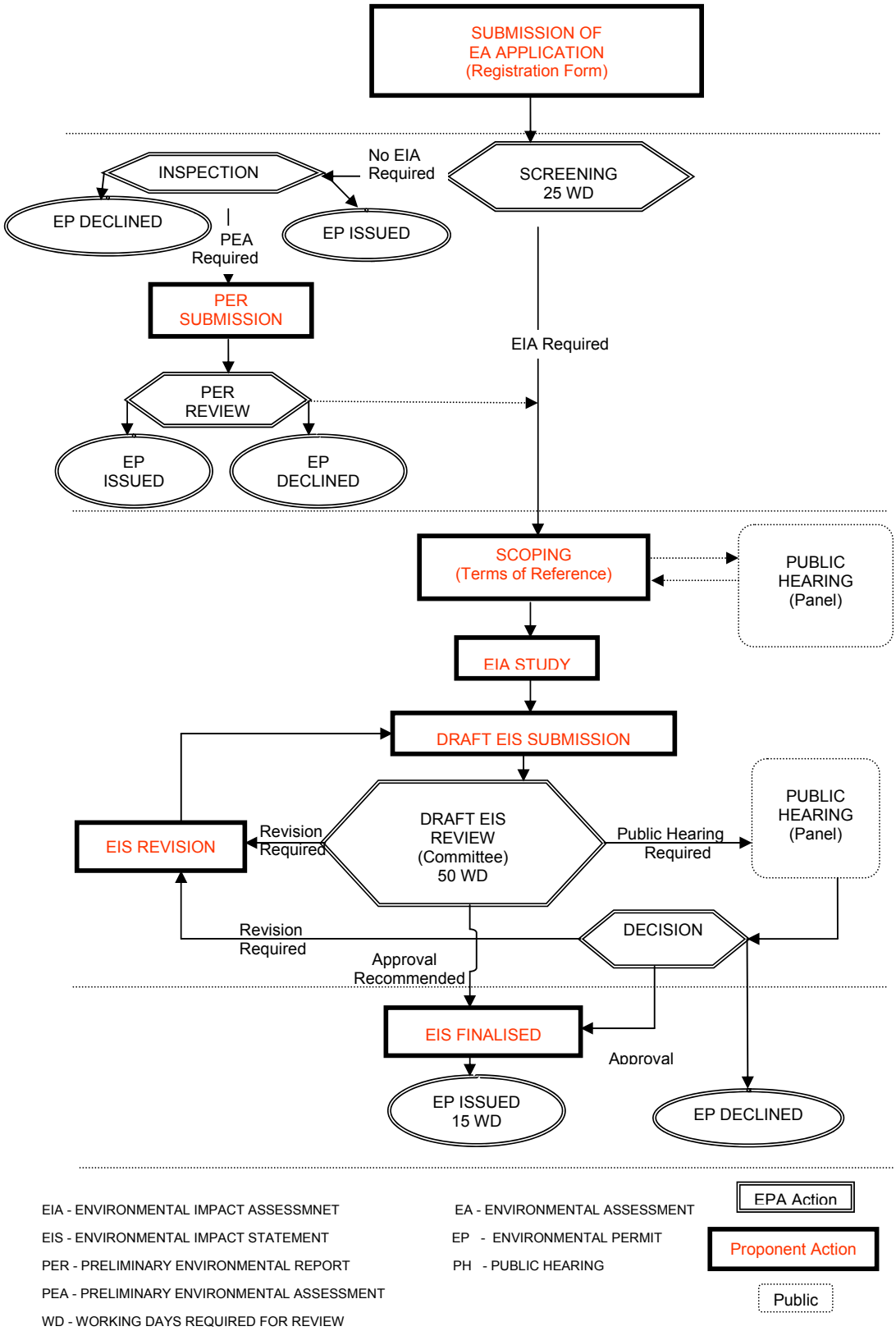
(c) The concerns of the general public, if any, and in particular concerns of immediate residents, if any

(d) Land use

(e) Any other factors of relevance to the particular undertaking to which the application relates.

Screening of applications is carried out in order to determine which projects, out of all those proposed at the identification phase of the project cycle, need further environmental consideration and to exclude those unlikely to have harmful environmental impacts. Following the application screening, the EPA may approve it and issue the permit, reject the project, or request submission of a preliminary environment report or an environmental impact statement.

Figure 3.6: The EIA Procedural Cycle in Ghana



The **preliminary environment report** can be viewed as a response to the Agency's request for additional information about the project and "shall contain details other than information submitted with the original application for the environmental permit and shall state specifically the detailed effects of the proposed undertaking on the environment." Its submission might result in granting of environmental permit to start operations. Alternatively, the EPA has a right to advise the project proponent to carry out scoping for the EIA to generate the appropriate terms of reference to guide a satisfactory EIA study.

Scoping is the process of outlining the scope of the environmental impact assessment to be carried out by the applicant, and includes the draft terms of reference, which indicates the essential issues to be addressed in the environmental impact statement. Section 12 of the Regulations suggests the following outline for the **draft terms of reference**:

(a) A description of the undertaking

(b) An analysis of the need for the undertaking

(c) An analysis of the alternatives to the undertaking

(d) Description of site selection process, including a justification for the proposed site and whether any other alternative site was considered

(e) Identification of existing environmental conditions including social, economic and other aspects of major environmental concern

(f) Information on potential, positive and negative impacts of the proposed undertaking from the environmental, social, economic and cultural perspective throughout the different phases of development

(g) The potential impact on the health of the local population

(h) Proposals to mitigate potential negative socio-economic, cultural and public health impacts on the environment

(i) Activities for monitoring predictable environmental impacts and proposed mitigating measures

(j) New or existing contingency plans to address unpredicted negative environmental impacts and proposed mitigating measures

(k) Consultation with members of the public likely to be affected by the operations of the undertaking

(l) Maps, plans, tables, graphs, diagrams and other illustrative materials that will assist with comprehension of the contents of the environmental impact statement

(m) A provisional environmental management plan

(n) Compensation payment methods for possible damage to land or property arising from the operation of the undertaking

(o) Assessment of impact that may go beyond the national borders of Ghana

Scoping is meant to focus the EIA on the key issues, concerns and decision areas and to solicit input and guidance from all relevant stakeholders on the Terms of Reference. **Scoping notices** must be appropriately served to facilitate stakeholder involvement.

The following stakeholders are considered as key actors in EIA for a project proposal:

- The proponent

- Environmental Protection Agency (EPA)
- Relevant Metropolitan/Municipal/District Assembly
- Relevant Ministry and Departments
- Other stakeholders (affected and interested parties)

The applicant prepares **environmental impact statement** based on the approved scoping report. Section 14 of the Regulations stipulates that the statement must address possible direct and indirect environmental impacts of the undertaking at the pre-construction, construction, operation, decommissioning and post-decommissioning phases, including:

(a) Concentrations of pollutants in environmental media including air, water and land from mobile or fixed sources

(b) Any direct ecological changes resulting from pollutant concentrations as they relate to communities, habitats, flora and fauna

(c) Alteration in ecological processes such as transfer of energy through food chains, decomposition and bio-accumulation, which could affect any community, habitat or species of flora or fauna

(d) Ecological consequences of direct destruction of existing habitats from activities such as dumping of waste, vegetation clearance and fillings

(e) Noise and vibration levels

(f) Odour

(g) Vehicle traffic generation and potential for increase in road accidents

(h) Changes in social, cultural and economic patterns relating to:

- Decline in existing or potential use of valued resources arising from matters referred to in paragraphs (a) to (d) of this sub-regulation
- Direct or indirect employment generation
- Immigration and resultant demographic changes
- Provision of infrastructure such as roads, schools and health facilities
- Local economy
- Cultural changes including possible conflict arising from immigration and tourism
- Potential land use in the area of the proposed undertaking

An environmental impact statement shall also include information on the possible health effects of the undertaking on persons within and around the vicinity of the proposed undertaking.

The environmental impact statement is received by the Agency, which, under certain conditions (for example, great adverse public reaction to the proposed project), might decide to organise a public hearing.

Once issued, the environmental permit is valid for 18 months and failure to commence operation within this period invalidates the permit. Each environmental permit is accompanied by a set of conditions spelt out in an attached schedule. These conditions are project-specific and are set on a case-by-case basis. Thus, a permit for construction of a transmission line might include, among others, specific requirements with respect to

the acquisition of the right of way, construction site traffic management, solid and liquid waste management, respect of forestry and wildlife preservation guidelines, avoidance of cultural and religious properties.

Having granted a permit, the Agency continues to monitor a proposed development. In particular, a project proponent must conform to the following requirements:

1. An **Annual Environmental Report** must be submitted on all undertakings after 12 months from the date of commencement of operation and every 12 months thereafter.

2. An **Environmental Management Plan (EMP)** must be submitted on approved undertakings within 18 months of commencement of operations and thereafter updated every three years.

3. An **Environmental Certificate** replacing the environmental permit must be obtained from the Agency within 24 months of the commencement of an approved undertaking.

The format and contents of the above documents are also determined by the Agency on a case-by-case basis.

III. Implications for the Electricity Sector

With respect to the national energy sector development, the national Environmental Action Plan stresses that the environmental impact of energy sector operations has been pervasive, affecting both the natural and man-made habitat. For example, hydro dams for power generation create environmental problems such as destruction of forest, water logging of lakeshores, public health hazards, siltation of deltas and destruction of certain aquatic life forms.

It was resolved that development of the country's indigenous energy resources should be conducted in such a manner as to reduce the adverse impacts on the environment. In line with this decision, electrical installations in Ghana require either an environmental permit or a full EIA.

Thus, Schedule 1 of the Regulations lists the following projects among the undertakings requiring registration and an environmental permit:

- Diesel electric power generating plants having a capacity greater than 1 megawatt
- Gas turbine electric power generating plants having a capacity greater than 1 megawatt
- Nuclear electric power generating plants
- Construction of hydroelectric power developments

Schedule 2 of the Regulations lists the following power generation and transmission projects among the undertakings for which environmental impact assessments are mandatory:

a. Construction of steam generated power stations
b. Dams and hydroelectric power schemes
c. Construction of combined cycle facilities in national parks
d. Construction of nuclear-fuelled power stations

e. Erection of power transmission lines

It should be pointed out that any projects located in environmentally sensitive areas fall into the mandatory EIA category. Schedule 5 (Regulation 30 (2)) provides a list of environmentally sensitive areas.[4]

In Ghana, there exist ambient air quality and ambient noise level standards as well as norms for discharge into water and air. Thus, Schedule 1 (Regulation 2) defines maximum permissible concentration of pollutants in discharge water separately for new (Column 2) and existing facilities (Column 3) as shown in Table 3.8. The values of certain indicators differ remarkably for existing and new facilities. Column 4 shows maximum permissible levels specifically for thermal power plants quoted from "Sector-specific Effluent Quality Guidelines for Discharges in Natural Water Bodies".

Table 3.8: Wastewater Quality Guidelines for Discharges into Water Bodies or Water Courses

Parameter/Description	Maximum Permissible Level (New Facilities)	Maximum Target (Permissible) Level (Existing Facilities)	Thermal Power Plant
Column 1	**Column 2**	**Column 3**	**Column 4**
Aluminium (mg/l)	5.0	5.0	
BOD_5 (mg/l)	50	200	50
COD (mg/l)	250	1,000	250
Colour (TCU)	20	100	200
Conductivity (μS/cm)	1,500	1,500	
Chromium (+6) mg/l	0.1	0.1	
Chromium Total (mg/l)	0.5	0.5	
Copper (mg/l)	2.5	2.5	
Hardness (total) (mg/l)	500	2,000	
Influent raw water / Upstream raw water	IR+15% of raw water parameter[5]	IR+15% of raw water parameter	
Lead (mg/l)	0.1	0.1	0.1
Nitrate	50	50	50
Oil	No visible floating oil	No visible floating oil	
Oil and Grease (mg/l)	20	20	5

[4] The text of Schedule 5 is quoted in its entirety in Box 4.4 to be found in Section 4 (4.3).

[5] The maximum permissible allowable effluent discharge from a plant either new or existing that uses raw water (seawater, river water or underground water) for its operations is that the resulting effluent quality should not be more than the quality of the original influent plus 15% the quality of the influent for all parameters of interest. For example, if influent BOD is 20 mg/l then maximum allowable effluent should be 20 mg/l + 15% of 20 mg/l.

Column 1	Column 2	Column 3	Column 4
Phosphorous Total	2.0	10.0	2.0
Sulphate (mg/l)	300	2,000	
Sulphide (mg/l)	1.5	1.5	1.5
Temperature Increase*	<3^{o}C above ambient	<3^{o}C above ambient	<3^{o}C above ambient
Total Dissolved Solids (mg/l)	1000	1000	
Total Suspended Solids (mg/l)	50	50	50
Total (all) metals (mg/l)	10		
Total toxic metals (mg/l)**	5		
Turbidity (NTU)	75	75	75
Zinc (mg/l)	5.0	5.0	

* Applicable at the edge of the zone where initial mixing and dilution take place. Where the zone is not defined, 100 meters from the point of discharge shall be used.

** Toxic metals include antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, zinc etc.

Schedule 2 (Regulation 3) sets waste discharge standards for air and Schedule 3 (Regulation 8) provides guidelines for ambient air quality as illustrated in Tables 3.9 and 3.10 respectively.

Table 3.9: Waste Discharge Standards – Air (Maximum Limits)

Pollutant	Applicable to	Standard
Smoke	All stationary fuel burning source	Ringlemann N^{o}.2 or equivalent opacity (not to exceed more than 5 minutes in any period of one hour)
Solid particles	Any trade, industry, process, industrial plant or fuel-burning equipment	200 mg/m^3
Hydrogen Chloride	Any trade, industry or process	200mg/m^3 as hydrogen chloride
Chlorine	Any trade, industry or process	100mg/m^3 as chlorine
Hydrogen sulphide	Any trade, industry or process	5 ppm as hydrogen sulphide gas
Nitric acid or oxides or nitrogen	Any trade, industry or process in which the manufacture of nitric acid is carried out	2000 mg/m^3 as nitrogen dioxide
Nitric acid or oxides of Nitrogen	Any trade, industry or process other than nitric acid plant	1000 mg/m^3 as nitrogen dioxide
Carbon monoxide	Any trade, industry or process	1000 mg/m^3 as carbon monoxide

Table 3.10: Ambient Air Quality Guidelines

Substance	Time Weighted Average (TWA)		Averaging Time
Sulphur Dioxide (SO_2)	900 µg/m^3	Industrial	1 hour
	700 µg/m^3	Residential	1 hour
	150 µg/m^3	Industrial	24 hours
	100 µg/m^3	Residential	24 hours
	80 µg/m^3	Industrial	1 year
	50 µg/m^3	Residential	1 year
Nitrogen Oxides (Measured as $N0_2$)	400 µg/m^3	Industrial	1 hour
	200 µg/m^3	Residential	1 hour
	150 µg/m^3	Industrial	24 hours
	60 µg/m^3	Residential	24 hours
Total Suspended Particulate	230 µg/m^3	Industrial	24 hours
	150 µg/m^3	Residential	24 hours
	75 µg/m^3	Industrial	1 year
	60 µg/m^3	Residential	1 year
PM_{10}	70 µg/m^3		24 hours
Smoke	150 µg/m^3	Industrial	24 hours
	100 µg/m^3	Residential	24 hours
	50 µg/m^3	Industrial	1 hour
	30 mg/m^3	Residential	1 hour
Carbon Monoxide	100 mg/m^3		15 min
	60 mg/m^3		30 min
	30 mg/m^3		1 hour
	10 mg/m^3		8 hours
Hydrogen Sulphide	150 µg/m^3		24 hours
Mercury	1 µg/m^3		1 year
Lead	2.5 µg/m^3		1 year
Cadmium	10 - 20 ng/m^3		1 year
Manganese	1 µg/m^3		24 hours
Dichloromethane (Methylene Chloride)	3 mg/m^3		24 hours
1,2-Dichloroethane	0.7 mg/m^3		24 hours
Trichloroethane	1 mg/m^3		24 hours
Tetrachloroethene	5 mg/m^3		24 hours

Noise control and enforcement of its appropriate levels have become a principal environmental concern, particularly in urban settlements with high population growth. Schedule 4 (Regulation 10) sets the permissible ambient noise level standards as presented in Table 3.11 below:

Table 3.11: Ambient Noise Level Standards in Ghana

Zone	Description of Area of Noise Reception	Permissible Noise Level in dB (A)	
		Day 06:00 – 22:00	Night 22:00 – 06:00
A	Residential areas with negligible or infrequent transportation	65	48
B1	Educational (school) and health (hospital clinic) facilities	55	50
B2	Area with some commercial or light industry	60	55
C1	Area with some light industry, place of entertainment or public assembly and place of worship such as churches and mosques	65	60
C2	Predominantly commercial areas	75	65
D	Light industrial areas	70	60
E	Predominantly heavy industrial areas	70	70

In 1997, in order to comply with the EPA's requirement for registering existing undertakings, the **Ghana Energy Commission** demanded national electricity providers (existing and new entrants) to produce an environmental impact assessment report, certified by the EPA, indicating that the activities of the service provider will not degrade the environment, adequate and proven emission controls have been put in place, or such controls have been included in the undertaking's design to minimize environmental damage. Although not without difficulties in the beginning, the process of registering the existing facilities (e.g., service stations) is now adequately structured and on-going.

National electric utility company **Volta River Authority** welcomed new national regulatory procedures for the environmental impact assessment. The company has been dealing with the environmental impacts of electricity infrastructure development (transmission lines and generation facilities) for many years but lacked efficient regulatory guidance and support.

Specialists from various departments were handling EIA issues on a project-by-project basis. However, with increased public attention to the environmental issues and, consequently, the demand for improved quality of work, a separate Environment & Sustainable Development Department was created in 2002.

Due to the absence of national EIA guidelines for electric installations, VRA environmentalists are using policies of international institutions like the World Bank and the IFC. These procedures are sometimes difficult to apply, as they do not necessarily take into account Ghana's uniqueness. However, the scoping process imposed by national regulator helps to better focus the EIA on the particularities of Ghana's situation.

IV. Ghana Legal References

1. Energy Commission Act, 1997. (Act 541)
2. Environmental Assessment Regulations, 1999
3. Environmental Assessment (Amendment) Regulations, 2002
4. Environmental Protection Agency Act 1994. (Act 490)
5. Forestry Commission Act 453, 1993
6. Lands (Statutory Wayleaves) Act, 1964 (Act 186)
7. Lands (Statutory Wayleaves) Regulations, 1964 (L.I.334)
8. Lands (Statutory Wayleaves) (Amendment) Regulations, 1964 (L.I.346)
9. The Volta River Authority (Transmission Line Protection) Regulations, 1967 (L.I. 542)
10. Water Resources Commission Act 522, 1996

V. Institutions to Contact in Ghana

Environmental Protection Agency (EPA)

PO Box M326

Ministries Post Office

Accra, Ghana

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GUINEA

I. Legal and Regulatory Framework

The Republic of Guinea adopted its **Code for Protection and Enhancement of Environment** *(Code sur la protection et la mise en valeur de l'environnement)* in 1987. The Code aims "to establish fundamental principles for management and protection of the environment against all sorts of degradation in order to preserve and enhance exploitation of natural resources, prevent different types of pollution and improve the living conditions of citizens, while respecting the equilibrium of their relationship with the surrounding environment" (Article 1).

Up to the beginning of 2004, **the National Directorate of Environment** *(Direction Nationale de l'Environnement - DNE)* within the Ministry of Mines, Geology and Environment was responsible for implementation of the national policy for protection of environment. In March 2004, however, a **Ministry of Environment** was created by a separate presidential Decree. The Ministry assures implementation of the procedural process for the environmental impact studies. It coordinates all sectoral activities with respect to environmental issues through its technical units and, in particular, the National Directorate of Environment.

In Guinea, establishments that "present or are likely to present serious danger for public health, security, hygiene, agriculture, fishery, preservation of sites and monuments, neighbourhood or Guinean environment preservation in general" are divided into two classes according to the gravity of negative impacts that are likely to result from their operation:

The 1st class:	Includes the establishments, which can be allowed to operate only if all measures are taken to prevent serious dangers and nuisances.
The 2nd class:	Includes the establishments, which do not present serious consequences for protection of the environment and are subject to general prescriptions.

Establishments listed in the 1st class are subject to an environment impact study, whereas those belonging to the 2nd class need **authorisation** of the National Environment Department. The Department has 30 days to issue an authorization for a 2nd class project.

In Guinea, norms and standards for emission of pollutants into receiving medium (air, soil, water) are currently under development at the national level.

II. The EIA Process

Article 82 of the Code for protection of environment rules that "when establishments, works or installations are likely to affect the environment because of their size, nature of activities or impact on the nature, the sponsor or executing agent shall elaborate and submit to the ministerial authority in charge of environment an **environmental impact study** evaluating direct and indirect impacts of the project on the Guinean ecological equilibrium, quality of living conditions of the affected population and effects on the protection of environment in general."

In Guinea, an EIA must include the following elements:

- Analysis of the initial state of the site and its environment
- Evaluation of the anticipated consequences of the project on the site and its natural and human environment
- Description of measures planned by the promoter to eliminate, reduce and, if possible, compensate harmful consequences of the project on the environment and an estimate of associated costs
- Presentation of the other possible solutions and reasons the project received environmental approval

The Minister of Environment approves studies based on the technical opinion of the National Department of Environment, which reviews the documents and controls implementation of the prescribed measures. For projects having less significant environmental impacts, the NDE elaborates the terms of reference and the promoters select an executing agency, which performs the EIA. For more complex projects, the NDE representatives are integrated in the team that carries out an EIA in order to enhance its personnel experience, prepare environmental monitoring of the project, and to better evaluate the proposed mitigation measures.

III. Implications for the Electricity Sector

In Guinea, an EIA study is mandatory for the following energy sector projects:

- Construction of hydroelectric dams and plants and thermal plants with capacity greater than 500 kW.
- Construction of electric line with capacity greater than 225 kV.
- Installations for underground storage of liquid and liquefied hydrocarbons with capacity greater than 3,000 m^3.

The national electricity sector operator, **Electricité de Guinée (EDG)**, is responsible for the environmental impact of its installations and operations. The company is currently involved in the process of environmental impact assessments of the Sambangalou dam, hydroelectric plant and a line interconnecting four neighbouring countries within the OMVG framework.

In 2003, an Environmental Service was created within the Planning and Equipment Division of EDG in order to manage in cooperation with the Ministry of Environment the environmental issues with respect to the company's generation, transmission and distribution activities. The Service is preparing the company's guide on environmental conduct. In particular, the Service is in charge of:

- Monitoring the river basins used for hydro generation.
- Creating an inventory of dangerous chemicals (effluents and solid waste) in order to carry out a qualitative analysis of the pollutants and elaborate the most appropriate treatment methods for each category of pollutants.
- Managing pollution and other harmful effects of the thermal and hydro generation units.
- Serving as an interface between EDG and national and international institutions in charge of environmental protection and management.

In order to properly accomplish the above tasks, the Service plans to establish an environmental database. The data will be used to develop a matrix of the potential impacts from the electricity sector's various activities. It is further planned to establish a mitigation plan and a communication programme to sensitise users of various ecosystems found within proximity to the EDG's installations.

IV. Guinea Legal References

1. Ordonnance No 045/PRG/87 du 28 mai 1987 portant Code de l'Environnement de la République de Guinée.
2. Ordonnance N°022/PRG du 10 mars 1987 modifiant le Code de l'Environnement de la République de Guinée.
3. Décret N^{o} 200/PRG/SGG/89 du 8 novembre 1987 codifiant les études d'impact sur l'environnement.
4. Décret N^{o} 200/PRG/SGG/89 du 8 novembre 1987 portant régime juridique des « Installations classées pour la protection de l'environnement ».
5. Décret N^{o} 201/PRG/SGG/89 du 8 novembre 1987 portant la préservation du milieu marin contre toutes formes de pollution.
6. Plan National d'Action pour l'Environnement (PNAE).

V. Institutions to Contact in Guinea

Ministère de l'Environnement

Direction Nationale de l'Environnement

BP 3118 Conakry

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GUINEA-BISSAU

I. Legal and Regulatory Framework

In Guinea-Bissau, environmental issues are managed by the Directorate General for Environment of the State Secretariat in charge of Natural Resources, Energy and Industry. The country has certain laws regulating use of natural resources: Code of Water, Code of Mining, Law on Land, Law on Forest and Reference Law on Protected Zones.

In 1995, Guinea-Bissau signed and ratified three major Rio conventions: on Biological Diversity, Climatic Changes and on Fight against desertification.

National Strategy and Action Plan for environmental management ***(Statégie Nationale et Plan d'Action)*** were adopted by the Government on 21 February 2004 to serve as a reference framework. It includes several priority actions, such as sustainable management of available resources, poverty reduction and desertification. Its overall objective is to ensure sustainable development.

With financial support of the European Union and technical support of the World Union for Nature, Guinea-Bissau created a Legislative Environmental Centre ***(Centre Législatif Environnemental)***, which was paralyzed consequent to the event of 7 June 1998. The Centre was supposed to elaborate the Code of Environment and the Guide for Environmental Impact Studies.

The Government also decided to create a National Institute of Environment and an Institute of Biodiversity and Protected Zones. The draft legal framework for the two institutions has already been prepared.

It is planned to create a Cell for Evaluation of Environmental Impacts within the National Institute of Environment. The Cell will be in charge of assessing environmental impact of significant engineering projects related to electric power, infrastructure etc.

As a Member States of the *Organisation de Mise en Valeur du Fleuve Gambie (OMVG)*, Guinea-Bissau is involved in assessment of environmental impact of the Sambangalou hydroelectric dam and interconnection line project.

To date, despite the fact that development objectives have been defined, the legal and regulatory framework for protection of environment remains to be developed. Thus, in Guinea-Bissau there exist no administrative or regulatory procedures for environmental impact assessments.

II. Guinea-Bissau Legal References

1. Inventário das emmissões de gases com efeito de estufa na Guiné-Bissau. Ano de referência : 1994. Direcção Geral do Ambiente. Projecto GBS/97/G32/GEF/PNUD – "Mundanças Climáticas".

2. Stratégie Nationale et Plan d'Action pour la Conservation de la Diversité Biologique en Guinée-Bissau. Novembre 2002.

III. Institutions to Contact in Guinea-Bissau

State Secretariat in charge of Natural Resources, Energy, Industry and Environment

Directorate General of Environment

Service of Urban Environment and Environmental Evaluation

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LIBERIA

No information is available from Liberia at the time of writing of these Guidelines.

Institutions to Contact in Liberia

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MALI

I. Legal and Regulatory Framework

The Republic of Mali is a Sahelian country that has been facing multiple environmental problems both in urban and rural areas for several decades. In 1995, the cost of environmental degradation in Mali was estimated between FCFA 115 and 196 billion, which is as high as 20.9 to 26.5 per cent of national GDP, or twice as much as the country's external debt. Degradation has very harmful effects and different elements were used to calculate its cost. They include land erosion, deforestation, and pollution (air, water, and solid waste) from the viewpoint of their impact on living conditions and health of the country's population.

Today, the conservation of natural resources and protection of the environment are high priorities for the Government of Mali. This is reflected in article 15 of the **Constitution**, which states, "Every person has the right to a healthy environment. To protect, defend the environment and promote quality of life is a duty of all citizens and of the State".

In 1992 the Government promulgated Law 92-013/AN-RM to institute a national system of quality and control norms. Among other objectives, the law pursues that of assuring protection of environment in Mali.

The **National Policy for Protection of Environment** *(Politique nationale de protection de l'environnement - PNPE)* was developed after an analysis of the state of natural resources, surrounding environment and existing institutions in Mali. The Policy aims to guarantee a healthy environment and sustainable development by incorporating an environmental dimension in all decisions concerning design, planning and implementation of development policies, programmes and activities. A decentralised management approach is used in an attempt to make participants in social and economic development activities responsible at the local level.

In February 1994, in order to resolve numerous environmental problems and respond to the United Nations' Convention on fighting desertification, the Government of Mali decided to establish the **National Environmental Action Plan** *(Plan National d'Action Environnemental - PNAE)*, which would take into account both environmental issues and National Action Programmes. The local action programmes relate to each of eight country's regions and the District of Bamako.

The institutional framework for the establishment of the National Plan was initially created in 1994. It included a **Permanent Technical Secretariat** (*Secrétariat Technique Permanent - STP),* a Consulting Committee *(Comité consultatif)*[6] and an Inter-ministerial Committee (*Comité inter-ministériel)*[7]. In reality, the two Committees created to support and guide the process have never fulfilled their role. The Inter-ministerial Committee, which was supposed to meet once every quarter, has convened only once since 1994. In September 1997, the Permanent Technical Secretariat was transfered to the Ministry of Environment and the **Institutional Framework for Management of Environmental Issues** *(Cadre Institutionnel de la Gestion des Questions Environnementales - CIGQE)*

[6]The Consulting Committee consists of about thirty members, representing technical services, NGOs, civil society, and cooperation partners.

[7] The Inter-ministerial Committee, chaired by the Minister for Environment initially included seven ministers: Ministry of Rural development, Ministry of Health, Ministry of Mines, Energy and Hydraulics, Ministry of Native Arts and Tourism, Ministry of Public Works and Transport, Ministry of Urbanism, and Ministry of Finance.

was created by Decree N^{o} 01-415/PM-RM in December 1998. The Permanent Technical Secretariat became known under its French acronym *STP/CIGQE*.

In 1998, the Government created the **National Directorate for Sanitization and Pollution Control** (*Direction Nationale de l'Assainissement et du Contrôle des Pollutions et des Nuisances - DNACPN)* with a task to establish national policy for sanitization and pollution control, and ensure implementation of relevant legal texts. More specifically, the Directorate is in charge of:

- Ensuring that sector development policies, plans and programmes take into account environmental issues and that legally prescribed measures are implemented;
- Supervision and control of technical procedures for environmental impact assessment;
- Control of national norms relating of sanitization, pollution and nuisances.

During 2001, several decrees were adopted with the objective of defining rules for evacuation of solid waste, wastewater and oily sludge, noise and atmospheric pollutants. However, pollution norms remain undefined due to the lack of funding. In addition, Mali does not have a Code of Environment, which could serve as a reference framework for development of various economy sectors.

II. The EIA Process

EIA procedures were introduced in Mali in July 1999. Experience in implementing the EIA procedures revealed that the text of the decree adopted in 1999 was insufficient. Drawbacks were noticed in such areas as projects classification, presentation of terms of reference and public participation. New Decree 03-594/P-RM relative to environmental impact studies was promulgated on 31 December 2003.

The decree divides projects and programmes into three categories according to significance of their impact on environment:

Category I Subject to an **in-depth environmental impact assessment**, are those that could have extremely negative effects, of irreversible nature, without precedent, often spreading far beyond the project area.

Category II Subject to a **simplified procedure**, are the projects whose negative effects on environment and on the population are less significant than those of the projects of Category I. Such impacts are of local nature and rarely irreversible.

Category III Require a **notice of environmental impact**. These projects do not have significant negative impacts on the environment.

Objectives of an environmental study are defined in the following manner:

- Prevention of the deterioration of the natural environment and living conditions of the population as a result of the implementation of development projects;
- Reduction and/or elimination of damages caused to the environment through mitigation measures, compensation or correction of harmful effects;

- Optimisation of equilibrium between socio-economic development and the environment;
- Involvement of the population, territorial administrations and other concerned organizations in different implementation phases of projects;
- Provision of relevant information necessary for decision-making.

The in-depth environmental impact study – mandatory for electrification projects – is characterised by:

- Identification and detailed evaluation of environmental, social and sanitary impacts;
- Detailed description of public consultation methods;
- Environmental monitoring and surveillance plan taking into account all the environmental, social and sanitary aspects.

Every project or programme promoter is required to submit the following information to the National Directorate for Sanitization and Pollution Control:

1. Promoter's name and address
2. Name and address of environmental consultants or a company (if any) chosen by the promoter
3. A copy of a project document
4. **Draft terms of reference** of the EIA study to be carried out compliant with the guidelines provided by a competent service.

From the date of receipt of the submission, the Directorate has 15 days to approve the terms of reference indicating the nature and scope of the EIA. Such an approval is issued following a site visit by a multi-sector commission for Category I projects.

Once the Directorate approves the terms of reference of the EIA study, the project promoter is required to inform the population in the development area and organise a **public consultation**. Such consultations are carried out in two phases:

1. The groups likely to be affected by the project, local non-governmental organizations are consulted at the time the terms of reference are established.

2. Wider consultations with target groups are organised in the presence of a local administration at the time the EIA report is established.

Minutes of the meetings must be annexed to the EIA report. A separate decree signed by the Ministers in charge of Environment and Territorial Administration shall define the exact requirements for a public consultation.

The promoter must submit 15 copies of the EIA report to the Directorate. If, upon review, the Minister of Environment considers the report satisfactory, he/she will issue a certificate that authorises project implementation and stipulates any necessary conditions defined by the Minister.

If the Minister of Environment does not communicate his/her decision within sixty days (60) days of receipt of the EIA report, the promoter is authorised to commence the project by default.

However, any project that does not start three years from the approval date of the environmental study becomes subject to a new EIA study.

An EIA study must contain the following components:

- Non-technical executive summary of the EIA study.
- General description of the proposed project, characteristics and limits of the scope of the study and the main parties concerned.
- Description of the environment of the proposed project: physical, biological and socio-cultural characteristics, and the threats to environment.
- Identification and evaluation of the proposed project's positive and negative potential impacts on environment: direct and indirect, short- and long-term, primary and secondary, locally and further away.
- Analysis of alternative solutions.
- Estimate of the kinds and quantities of expected effluents and emissions (water, air and land pollution, noise, vibration etc) produced by the project.
- Description of prevention and mitigation measures to reduce the harmful effects on the environment. Also, a description of alternative measures or significant effects on nature, landscape and human habitat that cannot be compensated.
- Brief description of the public consultation methods and expected results.
- Cost and benefit analysis.
- Impact monitoring and surveillance plan. The new decree requires that promoters implement environmental monitoring and surveillance plan in collaboration with concerned technical services and local administration.
- Estimated cost of mitigation measures.

III. Implications for the Electricity Sector

The **National Programme for Development of New and Renewable Energy Resources (***Programme National de Développement des Ressources en Energies Nouvelles and Renouvelables - PNENR)* includes, among others, the following objectives:

- To increase generation of hydroelectricity
- To develop research on pourghere[8] and alternative energies
- To develop measures that encourage the use of techniques and technologies for the rational utilisation of fossil energies
- To promote techniques and technologies for rational use of energy.

The following projects are classified as belonging to the first category of projects that are likely to have significant negative impacts:

[8] Pourghere is non-edible plant that flourishes in Mali's dry Sahel conditions. It goes by the same name in French and English languages, although in English it is also known as Jathropha. A platform designed to run on diesel oil can also burn pourghere oil, which is obtained from the plant freely growing in populated regions of Mali. Energy produced by one litre of fuel oil and used to crush pourghere seeds can yield up to 21 litres of pourghere fuel.

1 Dams for hydroelectricity generation

2 Works related to canalisation and modification of water flows

3 Thermal and nuclear plants

4 High voltage transmission lines

Energie du Mali - S.A. (EDM), an electric utility in Mali, is conscientious of the environmental impact of its installations. At the end of 2002, an attempt was made to elaborate terms of reference for an internal procedure for environmental monitoring. However, this initiative was not implemented.

Almost half of the Mali's installed electricity generation capacity is of thermal origin. As with all thermal plants, these plants pose treatment and canalisation problems from the generation of waste. Today, residues are put in storage as both scheming plants and incinerators stopped functioning several years ago.

EDM would like to measure both the quantitative and qualitative characteristics of emissions into air and water as well as noise levels resulting from its installations. However, the necessary measures have not been taken yet. Absence of national technical norms does not facilitate further progress in this respect.

EDM responds to environmental problems on a project-by-project basis. New programmes are given priority, especially the projects implemented with the help of international financing institutions. In 2003, EDM created a Service of environmental studies within the Central Directorate of Investment *(Direction Centrale des Investissements - DCI)*.

IV. Mali Legal References

3. Décret N^{o} 03-594/P-RM du 31 décembre 2003 relatif à l'étude d'impact sur l'environnement.
4. Décret 01-394/P-RM du 06 septembre 2001 fixant les modalités de gestion des déchets solides.
5. Décret 01-395/P-RM du 06 septembre 2001 fixant les modalités de gestion des eaux usées et des gadoues.
6. Décret 01-396/P-RM du 06 septembre 2001 fixant les modalités de gestion des pollutions sonores.
7. Décret 01-397/P-RM du 06 septembre 2001 fixant les modalités de gestion des polluants de l'atmosphère.
8. Loi N^{o} 01-20 du 30 mai 2001 relative aux pollutions et aux nuisances;
9. Décret 99-189/P-RM du 5 juillet 1999 portant institution de la procédure d'étude d'impact sur l'environnement.
10. Décret N^{o} 01-415/PM-RM du 24 décembre 1998 portant la création du Cadre Institutionnel de la Gestion des Questions Environnementales.
11. Loi N^{o} 98-058 du 17 décembre 1998 ratifiant l'ordonnance No 98-027 /P-RM du 25 août 1998 portant création de la Direction Nationale de l'Assainissement et du Contrôle des Pollutions et des Nuisances.
12. Ordonnance N^{o} 98-027 /P-RM du 25 août 1998 portant création de la Direction Nationale de l'Assainissement et du Contrôle des Pollutions et des Nuisances.

13. Plan National d'Action Environnemental de la République du Mali. 1996.
14. Politique Nationale de Protection de l'Environnement. 1996.
15. Loi N° 95-031 du 20 mars 1995 portant condition de gestion de la faune sauvage et de son habitat.
16. Loi N° 95-032 du 20 mars 1995 portant condition de gestion de la pêche et de la pisciculture.
17. Loi N° 95-004 du 18 janvier 1995 portant condition de gestion des ressources forestières.
18. Loi N° 92-013/AN-RM du 17 décembre 1992, instituant un système national de normalisation et du contrôle de qualité.
19. Décret N° 90-355/P-RM du 8 aout 1990, portant fixation de la liste des déchets toxiques et les modalités d'application de la loi n° 89-61/AN- RM.

V. Institutions to Contact in Mali

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NIGER

I. Legal and Regulatory Framework

In the Republic of Niger, much of the national policy in the environmental field is defined by the environmental law dated 29 December 1998 and confirmed by the constitution of 9 August 1999. Article 4 of the law states that "every citizen has a right to a healthy environment. The state is responsible for protection of environment in the general interest. It is everybody's duty to contribute to protection and improvement of the environment in which he lives."

The **Ministry of Hydraulics and Environment** *(Ministère de l'Hydraulique et de l'Environnement - MHE)* was created in 1982. The Minister of Environment is responsible for implementation of national environmental policy in coordination with the other ministries and institutions. The national coordinating entity assists the Minister of Environment in his mission to establish, execute and control environmental policies. This entity is called **National Council for Environment and Sustainable Development** *(Conseil National pour l'Environnement et le Développement Durable - CNEDD)*. The Council is in charge of the elaboration and implementation of the **National Plan for Environment and Sustainable Development** *(Plan National pour l'Environnement et le Développement Durable - PNEDD)*. The Plan was prepared in 1998 and is subject to revision every five years.

In October 1997, a special order established the **Bureau of Environmental Evaluations and Impact Studies** *(Bureau d'Evaluations Environnementales et des Etudes d'Impacts - BEEEI)*. A decree dated 12 October 2000 specifies that the Bureau's tasks are to:

- Control and evaluate environmental impact assessment studies and their conformity to the terms of reference
- Prepare certificates of conformity
- Carry out audits and monitor environmental statements submitted by promoters
- Elaborate technical norms of pollution and ensure their respect
- Elaborate environmental monitoring programmes
- Ensure compliance of evaluation procedures, review of environmental impacts and regulate all related legal issues
- Elaborate a guide for the EIA terms of reference
- Organise and conduct counter-expertise

In Niger, while the objectives and guiding principles of development are defined, many elements of the legislative framework for protection of the environment are still missing. Thus, 32 draft legal texts concerning different aspects of execution of the Law on Environment are currently waiting for adoption.

II. The EIA Process

The Law on Environment of Niger requires that development activities, projects and programmes, which, due to their significant scale or nature of impacts on natural and human environment, can produce damaging effects, be subject to a preliminary authorisation by the Minister of Environment.

Promoters are required to notify the Bureau of Environmental Evaluations in writing about their development project. The Bureau decides if the project is subject to a simplified or in-depth assessment and communicates its decision to the promoter within 48 hours upon notification. Promoters are required to submit to the Bureau the **terms of reference** of the envisaged EIA.

Once the terms of reference are approved, the EIA can commence and produce an **environmental impact study report** *(Rapport d'Etude d'Impacts sur l'Environnement – REIA).* The document is submitted to the Minister of Environment who receives technical evaluation from the Bureau and, if necessary, from other authorities. The report must contain all the necessary information to understand the project. Analysis of the EIA study aims to verify, from a scientific viewpoint, appropriateness and quality of the acquired data and scientific methods used for its collection and interpretation. The recommended contents of an environmental impact study report are detailed in Decree 397 dated 20 October 2000.

The Bureau is allowed twenty days from the date of receipt of a report to communicate its technical opinion to the Minister of Environment. The Minister makes a final decision based on the Bureau's input. The final decision should be made no later than seven working days from the date when the Bureau submitted the file.

III. Implications for the Electricity Sector

In Niger, the priority energy programme is one of the important elements of the *PNEDD*. The programme aims to ensure:

- Country's energy sufficiency and integrated management of different national resources
- Protection of the environment during the exploitation and consumption of energy resources
- Promotion of new and renewable energies
- Increased access to energy.

The list of activities and programmes that require an EIA can be found in Decree adopted on 20 October 2000. The decree states, "any operation or establishment for extraction or processing of matter for production of energy."

The national operator, **Société Nigérienne d'Electricité (NIGELEC),** does not have a department devoted to environmental issues. EIA studies are managed by the *Direction d'Etudes et d'Ingénierie* and outsourced to external consultants in accordance with the needs of each development project.

IV. Niger Legal References

1. Loi N° 98-56 du 29 décembre 1998 portant loi-cadre relative à la gestion de l'environnement ;
2. Loi N° 2003-004 du 31 janvier 2003 portant Code de l'Electricité ;
3. Décret N° 2000-369 du 21 octobre 2000 portant attribution, organisation et fonctionnement du Bureau d'Evaluation Environnementale et des Etudes d'Impact ;
4. Décret N° 2000-397 du 20 octobre 2000 portant sur la procédure administrative d'évaluation et d'examen des impacts sur l'environnement ;
5. Décret N° 2000-398 du 20 octobre 2000 déterminant la liste des activités, travaux et documents de planification assujettis aux Etudes d'Impacts sur l'Environnement ;
6. Plan national pour l'environnement et le développement durable. SE/CNEDD, juillet 1998.

V. Institutions to Contact in Niger

Ministère de l'Hydraulique, de l'Environnement et de la Lutte contre la Désertification

Bureau d'Evaluations Environnementales et des Etudes d'Impacts (BEEEI)

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NIGERIA

I. Legal and Regulatory Framework

In the Federal Republic of Nigeria, environmental issues became a concern of the Government in the late 1980s. The Federal Military Government of Nigeria created the **Federal Environmental Protection Agency (FEPA)** by Decree N° 58 in December 1988, and then formalised its functions by Decree N° 59 in 1992. The two documents became known as the FEPA Act. The Agency was created as an integral part of the Presidency with responsibility for the "protection and development of the environment and biodiversity conservation and sustainable development of Nigeria's natural resources." It became the Agency's duty to establish environmental criteria, guidelines, specifications and standards for the protection of the nation's air and inter-state waters as may be necessary to protect the health and welfare of the population from environmental degradation.

The FEPA Act encouraged States and Local Government Councils to set up their own Environmental Protection Bodies for the purposes of maintaining good environmental quality in their respective areas.

In 1991, FEPA released its Regulations with respect to pollution abatement and effluent limitation in industries and facilities generating wastes. The Regulations rule that "no industry or facility shall release hazardous or toxic substances into the air, water or land of Nigeria's ecosystems beyond limits approved by the Agency." Equally, every industry is required to install anti-pollution equipment for detoxification of effluent and chemical discharges emanating from the industry. Moreover, an industry or facility shall:

a. Have a pollution monitoring unit within its premises;
b. Have on-site a pollution control; or
c. Assign responsibility for pollution control to a person or body accredited by the Agency.

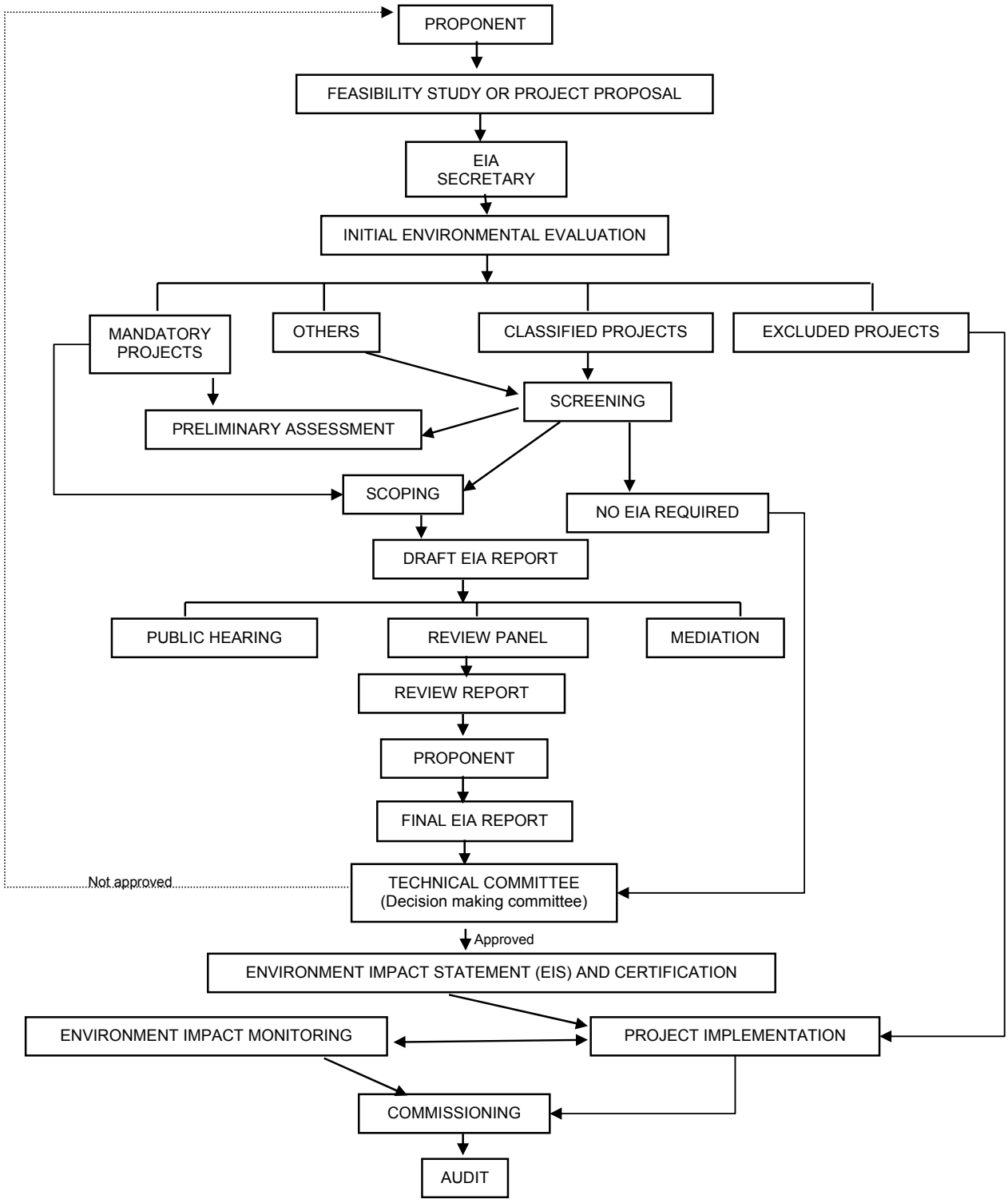
Schedule 1 of the Regulations establishes a list of industries required to control their effluent emissions and waste water parameters. Schedule 2 and 3 impose effluent and gaseous emissions limits.

In 1992, the Government issued the **Environmental Impact Assessment Decree** N° 86, which specified in its article 2-(1) that "the public or private sector of the economy shall not undertake or embark or authorise projects or activities without prior consideration, *at an early stages*, of their environmental effects."

The Decree set out the procedures and methods to enable the prior consideration of environmental impact assessment on certain private and public projects and gave specific powers to the FEPA to facilitate environmental assessment process. A list of Mandatory Study Activities was also drawn at that time.

In 1999, in the Third Republic, the new civil Government of Nigeria abolished FEPA and created the **Federal Ministry of Environment**, which has concerns in 36 States of the Federation. The Department of Environmental Assessment within the Ministry assumed FEPA's duties.

Figure 3.7: The Administrative Flow Chart of the EIA Process in Nigeria



II. The EIA Process

Nigerian federal EIA procedure is set by Decree N^{o} 86 of 1992. The procedure establishes the sequence of actions for the EIA process as illustrated in Figure 3.7:

(i) Project proposal development, submission and registration

The project promoter is required to fill in a pre-printed "EIA Notification Form", provided by the Ministry; elaborate an EIA study outline in a free format but to serve as much as possible as the actual **terms of reference** for the study; and, submit the file accompanied by an application fee of Naira 10,000.

The Ministry registers the project proposal and issues a registration number immediately.

(ii) Screening

The Ministry undertakes a site visit and provides appropriate advice with respect to the project proposal viability (Screening Report) in writing within 10 working days of receipt of the proposal.

(iii) Scoping

Upon receipt of the screening report the proponent shall carry out a scoping exercise to ensure that all significant impacts and reasonable alternatives are addressed in the intended EIA. At this stage the proponent is required to submit final terms of reference indicating the scope of the study. The Ministry may request from the proponent a preliminary assessment report and any additional information and public hearing depending on the public interest in the project. The proponent will undertake the EIA study in compliance with the approved TOR.

(iv) Draft EIA report

A draft report shall be submitted to the Ministry for review. Once the review process is completed, the relevant comments are communicated to the proponent within a minimum of one month after the review process.

The draft report submission must be accompanied by a ₦240,000 processing fee.

(v) Review process

This may include:

- In-house review
- Expert panel review (the sitting may be in public)
- Public review – public display and review of documents for a period of 21 working days
- Mediation

Additional site visits may be initiated at this stage. The Ministry shall inform the proponent in writing of the selected method(s) of review within 15 working days from the date of acknowledgement of the EIA draft report.

(vi) Final EIA report

The final report must include all issues raised at the review process and solutions identified by the proponent.

(vii) Certification

The final decision is reverted to the Minister of Environment in the format of an Environmental Impact Statement (EIS). An environmental conformity certificate is issued enabling the proponent to start project activities. The certificate has a limited validity period of 2 to 5 years and needs to be renewed on expiration.

(viii) Project implementation

While implementing the project, the proponent shall conform to the stipulated specification presented in the final EIA report. If the project is not commissioned within the validity period specified in the certificate, the proponent will need to seek revalidation of the certificate from the Ministry by re-submitting a revised and updated EIA report.

(ix) Mitigation compliance monitoring (prior to commissioning)

During the implementation phase of the project, the Ministry shall monitor the progress of the project from site preparation to commissioning in order to ensure compliance with all stipulated measures and specifications.

(x) Environmental auditing (post commissioning)

This involves a periodic assessment of the positive and negative impacts of the project. This is carried out by the Ministry to help improve the EIA process.

The time required for the whole EIA process depends on the nature of the project and is bound to last between 3 to 4 months. Upon completion of the process the Ministry applies a final assessment charge, which is computed taking into account all expenses incurred to facilitate the EIA process. Depending on the complexity of the process, such a charge may be between ₦300 thousand and ₦1 million.

III. Implications for the Electricity Sector

In 1992, the Federal Environmental Protection Agency was assigned the responsibility for "controls for atmospheric pollution originating from energy sources, including that produced … in power generation units." The Ministry of Environment inherited this responsibility.

The Nigerian list of Mandatory Study Activities includes the following projects under the heading of **Power Generation and Transmission**:

(a) Construction of steam generated power stations burning fossil fuels and having capacity of more than 10 megawatts.

(b) Dams and hydroelectric power schemes with either or both of the following:

  (i) Dams over 15 meters high and ancillary structures covering a total area in excess of 40 hectares;

  (ii) Reservoirs with a surface area in excess of 400 hectares.

(c) Construction of combined power cycle power stations.

(d) Construction of nuclear-fuelled power stations.

The regulatory framework in Nigeria provides numeric standards both for noise, ambient environment quality and emissions and effluents. These standards, affecting operations of the national electricity sector, are shown in Tables 3.12 and 3.13 below.

Table 3.12: Noise Exposure Limits in Nigeria

Duration per Day, Hour	Permissible Exposure Limit, dB (A)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

Note: Exposure to impulsive or impact noise should not exceed 140 dB (A) peak sound pressure level.

Table 3.13: Nigerian Ambient Air Quality Standards

Pollutant	Average Time	Limit
Particulate	Daily average of hourly values 1 hour	250 µ/m^3 600 µ/m^3
Sulphur Oxides (SO_x)	Daily average of hourly values 1 hour	0.01 ppm (210 µ/$m^{3)}$ 0.1 ppm (260 µ/m^3)
Non-methane Hydrocarbon	Daily average of 3 hourly values	160 µ/m^3
Carbon Monoxide (CO)	Daily average of 4 hourly values 8-hourly coverage	10 ppm (11.4 µ/m^3) 20 ppm (22.8 µ/m^3)
Nitrogen Oxides (NO_x)	Daily average of hourly values (range)	0.04 ppm – 0.06 ppm (75.0 µ/m^3 – 113 µ/m^3)
Photochemical oxidant	Hourly values	0.06 ppm
VOCs	Daily Average	50 µ/m^3
Ozone	Daily Average	0.2µ/m^3

In Nigeria, steam generation and steam electric power generation installations are required to control their effluent and gaseous emissions and wastewater. Limits of such emissions are established as shown in Tables 3.14 and 3.15.

Table 3.14: Norms of Effluent Emission Applicable to Electricity Sector in Nigeria

(Units in milligram per litre (mg/l) unless otherwise stated)

Parameter	Limit for Discharge into Surface Water	Limit for Land Application
BOD_5 at 20°C	30	50
Boron (as B)	5	5
Chlorine	1.0	-
Chromate Oil	N/A	N/A
Copper	Less than 1	-
Iron (as Fe)	20	-
Non-degradable Organics	N/A	N/A
Oil and Grease	10	20
pH	6-9	6-9
Phosphate (as PO_4^{3-})	5	10
Temperature	Less than 40°C within 15 meter of outfall	Less than 40°C
Total Dissolved Solids	2,000	2,000
Total Suspended Solids	30	-
Total Metals	3	-
Zinc	Less than 1	-

Table 3.15: Water Quality Guidelines for Power Generation Stations

(Concentration in milligram per litre (mg/l) Cooling Once-Through)

Parameter	Freshwater	Boiler FeedWater
Alkalinity as ($CaCo_3$)	500	< 1
Aluminium	-	< 0.01
Ammonia	-	< 0.07
Bicarbonate	< 600	< 0.05
Calcium	< 200	< 0.01
Carbon tetrachloride extract	-	N5
Chemical Oxygen Demand	< 75	< 1.0
Chloride	< 600	6
Copper	-	< 0.01
Dissolved Oxygen	-	< 0.007
Dissolved Solids	< 1,000	< 0.5
Hardness	< 850	< 0.07
Iron	-	< 0.01
Manganese	-	< 0.01
Magnesium	-	< 0.01
Organic material methylene blue active substances	-	< 0.1
pH unit	5.0 – 8.3	8.8 - 9.4
Silica	< 50	< 0.21
Sulphate	< 600	6
Total Suspended Solids	< 500	< 0.05
Zinc	-	< 0.01

Nigeria is among the few countries in the ECOWAS region to have developed national **Sector Guidelines for Electrification Projects**. The Guidelines start with an opening paragraph that states that “adequate supply of reasonably priced energy is essential for meeting the basic requirements of man, stimulating and supporting economic growth, and raising the standard of living. However, experience shows that a large number of adverse environmental effects can result from energy production and use, some of which can be mitigated to a considerable degree by careful planning and operation.”

The guidelines describe environmental impacts from the following electrification activities:

- Hydroelectric projects
- Fossil power plants
- Electric transmission lines
- Rural electrification
- Nuclear power plants
- Tidal power plants
- Solar power plants
- Geothermal power plants
- Biomass, biogas etc.

In addition, Nigerian guidelines provide promoters with an EIA checklist for the above types of electrification projects as well as a description of mitigation measures, through an environmental management plan and remediation plans after de-commissioning/closure. A recommended structure of an EIA report is also provided at the end of the document.

Keen on curbing negative impacts of the electricity sector operational activities, the **National Electric Power Authority (NEPA)** adopted its own environmental policy in January 2002. The NEPA's environmental policy states that:

- NEPA's ambition is to satisfy customers' demand for efficient, safe and environmentally friendly supply of electric energy.
- The natural resources on which our operations depend shall be harnessed with utmost possible care.
- In our effort to achieve environmental excellence in our operations, we shall continuously train and motivate all employees to perform their duties in an environmentally responsible manner.
- Facing our responsibility to enhance environmental protection, we shall take the interest of future generations into consideration when carrying out our development projects.
- In openness and with commitment to environmental issues related to power development, we shall endeavour to create and enjoy the confidence of our staff, customers and other stakeholders in our actions and operations.

In 2000, the company created an environment, resettlement and social unit. In 2002, the unit received a division status and was renamed the Environment & Resettlement Division.

NEPA endeavours to comply with the environmental requirements for both international power transmission projects (e.g., 330 kV Ikeja West – Sakété interconnection line with Benin) and national projects. The most important environmental impact assessment studies for national projects include:

- 56 km 330 kV transmission line to evacuate power from the thermal plant in Okpai being built by AGIP (as an IPP) in Delta State;

- NEPA-owned 828 MW gas turbine power station in Geregu;
- NEPA-owned Okitipupa 670 MW thermal power plant (proposed);
- 276 MW AFAM V gas turbine thermal power plant in Rivers State.

These EIA studies are outsourced to external consultants approved by the Ministry of Environment. In addition, the company has carried out an environmental audit of seven existing power stations.

IV. Nigeria Legal References

1. Environmental Impact Assessment Procedural Guidelines. FEPA, 1995.
2. Environmental Impact Assessment Sectoral Guidelines for Infrastructures. FEPA, September 1995.
3. Environmental Impact Assessment Decree N^{o} 86 of 1992.
4. Federal Environmental Protection Agency Act (as amended). Decree N^{o} 59 of 1992.
5. National Environmental Protection (Effluent Limitation) Regulations, 1991.
6. National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations, 1991.
7. Electricity Act. Cap 106 I.FN 1990.
8. Federal Environmental Protection Agency Act. Decree N^{o} 58 of 1988.

V. Institutions to Contact in Nigeria

Federal Ministry of Environment

Department of Environmental Assessment

Environment House

Airport Road

P.M.B. 468, Abuja

Nigeria

Tel.: (+234) 9 671 4928 / 2582

Fax: (+234) 9 523 4119

National Electric Power Authority (NEPA)

Environment & Resettlement Division

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Maitama, Abuja

Nigeria

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SENEGAL

I. Legal and Regulatory Framework

Article 8 of the Constitution of Republic of Senegal guarantees to all citizens "fundamental individual liberties, economic and social rights" including the right to a sound environment. These liberties and rights are guaranteed under conditions defined by the law.

In February 1995, Senegal started a decentralised and participative process to establish a national strategy to manage natural resources and the environment with the fundamental objective to promote the integration of environmental concerns into economic and social development.

In September 1997, the **National Environmental Action Plan** *(Plan National d'Action pour l'Environnement - PNAE)* was adopted and scheduled to be revised periodically. The Plan was prepared with the input of specialised studies, decentralised discussions, and recommendations formulated by different categories of participants relative to natural resources and environmental management. Activities undertaken for the Plan preparation required:

- Analysis of economic activities and evaluation of their impact on the environment,
- In-depth analysis related to principal environmental problems and challenges,
- Elaboration of regional environmental action plans and their subsequent synthesis on a eco-geographical basis,
- Synthesis of corrective sectoral strategies intended to enhance knowledge of methods used in different sectors to manage natural resources and the environment.

The first **Environmental Code** of Senegal was adopted in 1983. Its restrictive contents did not take into account all the fundamental elements of environmental management. A new Environmental Code was adopted 15 January 2001 *(Loi N^{o} 2001-01 portant Code de l'environnement)* to serve as a reference law.

In accordance with its article 3, the Code's objective is "to establish fundamental principles for management and protection of environment from all forms of degradation in order to enhance rational exploitation of natural resources, prevent various sources of pollution and nuisances, and improve living conditions of populations while respecting equilibrium of their relationship with the ambient environment."

The Code's provisions, as stated in its article 9, concern "factories, storage facilities, building sites, quarries, or other industrial and commercial installations operated or owned by any physical or moral person, public or private, and any other activities that either pose threats to health, security, public sanitation, agriculture, nature and environment in general, or cause inconveniencies to the neighbourhood."

The Code introduced **two categories of installations** in accordance with the danger or gravity of inconveniencies that their exploitation can present. Thus, depending on the potential impact, nature, scope and location of a project, it can belong to one of the following categories:

Category 1: Projects that are likely to have significant impact on the environment. An EIA study shall integrate environmental consideration in the economic and financial analysis of the project. Projects in this category are subject to a **full EIA** study.

Category 2: Projects that have limited impact on the environment if their effects can be mitigated with the help of specific measures or through modification in their design. Projects of this category are subject to an **initial environmental analysis**.

The Ministry of Environment and Protection of Nature is the principal institution responsible for environmental and social assessments. The **Directorate of Environment and Classified Establishments – DECE** *(la Direction de l'Environnement et des Etablissements Classés - DEEC)* is in charge of the Government environmental policy implementation, with respect to the protection of nature and people from pollution and nuisances.

Within the DECE, the Division of EIA Studies and Prevention and Control of Pollution and Nuisances is tasked to establish the terms of reference, evaluation of environmental impact studies conformity to legal requirements and monitoring of mitigation measures.

In 2001, a **Technical Committee**, external to the Ministry of Environment and composed of representatives from different Ministries and other organizations, was created as an administrative unit to manage EIA studies. The Committee's task is to validate EIA reports and assist the Minister of Environment in making decisions allowing or prohibiting development projects.

Another important task attributed to the Technical Committee is that of elaborating national environmental standards. In 2001 the Committee elaborated a national norm for used water effluent discharge (NS 05-061) and a norm for the atmospheric pollution in 2003 (NS 05-062).

The Senegalese norm for protection of atmosphere distinguishes between the values of ambient air quality and the maximum allowable values of effluent discharge emitted by fixed or mobile sources. In Senegal, a distinction is made between "immissions" and "emissions", defined in the following manner:

Immission: "A measure of concentration of different components permitting to judge the ambient air quality as affected by emissions from stationary installations, motor vehicles and meteorological factors influencing the dispersion of the pollutants."

Emission: "Gaseous effluent discharge measured at a source." The threshold values established for discharge define maximum allowable concentration of pollutants that can be emitted by a fixed r mobile source.

This approach is similar to that of imposed by the World Bank's operational policy described in Section 2 (2.4.4) of the Guidelines.

The maximum allowable levels of effluent discharge applicable to the electricity sector activities are indicated below in the sub-section III "Implications for the Electricity Sector".

II. The EIA Process

In Senegal, environmental regulation is based on the Environmental Code and a number of decrees adopted in 2001.

Article 48 of the Environmental Code defines environmental assessment as a systematic process consisting of evaluation of possibilities, natural resources, physical and social systems used "to facilitate planning of sustainable development and decision-making process in general, as well as to foresee and manage negative impacts and consequences of development proposals in particular; it includes EIA studies, strategic environmental evaluation and environmental audits."

Application Decree N^{o} 2001-282 dated 12 April 2001 clarifies in its article 39 that "an environmental impact assessment (EIA) evaluates expected effects on population's health, natural environment and sanitation; it can also cover social effects, namely with respect to specific needs of men and women, as well as particular groups, resettlement of displaced persons and consequences for local populations."

There is no generic methodology of EIA studies in Senegal and it is defined on a case-by-case basis. From the beginning, particular attention is paid to the contents of the terms of reference, which must be approved by the DECE.

The **terms of reference** of any EIA study must include the following elements:

1. Description of the project environment with special attention to the components likely to suffer from cumulative effects;
2. Evaluation of the environmental effects from a project's provisions for procurement in water, energy and primary materials;
3. Analysis of the project's impact on the local population, namely with respect to effects on children, women and men, natural resources (air, water, land, fauna, flora, health and cultural heritage);
4. Evaluation of measures envisaged for evacuation of waste water, removal of solid waste and reduction of emissions;
5. Identification of positive and negative impacts on environment;
6. Analysis of possibilities for improvement of environment;
7. Description of legal and institutional framework inclusive of environmental norms and procedures established for issuance of licences;
8. Evaluation of the environmental impact of provisions for determination of tariffs, taxes and subsidies;
9. Assessment of induced effects indicating norms used as criteria for evaluation;
10. Review of major alternative solutions accompanied by appraisal of consequences of an outright rejection of a project;
11. Description of mitigation measures or alternative project designs for reduction of harmful effects on the environment, accompanied by an implementation plan, an estimate of associated costs, work progress schedule and indication of an entity in charge of project monitoring;
12. Comparative analysis of project's alternative scenarios and mitigation measures taking into account the following factors: their capacity to eliminate negative effects, associated capital investment and recurring costs, appropriateness for the local conditions, requirements in institutional support, training and monitoring;

13. List of measures for protection and/or resettlement of affected population groups indicating their reaction to propositions made to them;
14. Non-technical executive summary of principal recommendations.

The EIA Report must contain the following items:

1. A title page indicating the name of the project, the promoter, the study authors, sector authority and of the competent body to which the study is submitted for review as well as the submission date;
2. A non-technical summary describing main results and recommendations of the EIA study;
3. A table of contents;
4. Lists of tables, figures and attachments;
5. An introduction describing the structure of the EIA report;
6. A full project description, including a justification of the project and its site, objectives and expected results, geographical limits of the project zone, methods, installations, products and other components;
7. An analysis of the initial state of the site and its environment, including base data on water, land, flora, fauna, air, physical, chemical, biological, socio-economic and cultural conditions;
8. A description of a legal framework of the study (a brief description of legislative framework in place);
9. Description and analysis of project alternatives (location, available technologies or operation methods):
    - Identification of feasible options
    - Comparative analysis of feasible options
    - Justification and description of the chosen option
10. An evaluation of probable impacts (positive or negative, direct, indirect, cumulative in short-, medium- and long-term) that the project is likely to generate at the end of its operational activity;
11. Risks related to technological accidents:
    - Analysis of risks related to technological accidents
    - Security measures and an emergency plan
12. Identification and description of preventive measures for control, suppression, mitigation and compensation of negative impacts;
13. Description of environmental monitoring and surveillance plan taking into consideration insufficiencies in the terms of available information and uncertainties with respect to the project implementation. Prior to the start of the construction, promoter shall submit a detailed environmental monitoring and surveillance plan containing estimated cost of all the recommended measures, their implementation schedule and entities responsible for monitoring;

14. An overall conclusion with respect to main measures to undertake in order to mitigate or eliminate the most significant negative impacts and to indicate problem areas likely to diminish validity of obtained results;

15. Attachments containing additional documents (sector reports) elaborated by the EIA study, main legal texts, bibliographical references, terms of reference of the EIA study and/or of additional or planned studies, maps, drawings, results of laboratory tests, photographic reports and press articles considered important for understanding of the work, minutes of information sessions, detailed inventories of methods and results, any other information judged useful for understanding of the project;

16. In case of industrial projects, certain information about manufacturing processes can be viewed by promoters as confidential. As an EIA study report is not a confidential document and is open for public consultation, it is advisable to put any sensitive information into a separate document.

Upon receipt of a project EIA, the Technical Committee has ten days to communicate to promoters its opinion with respect to the nature of the planned study. Le Comité Technique est chargé de la validation interne des EIE.

The EIA gives rise to a public hearing and the emphasis is placed on local measures and public participation. In 1996, certain rural development and environmental management responsibilities were delegated to decentralised territorial authorities (regional, rural and urban communities). In particular, local authorities affected by the project have to give an opinion on EIA reports. The local authorities are represented in the technical committee reviewing and managing environmental impact assessments (Order 9469).

III. Implications for the Electricity Sector

The Senegalese National Environmental Action Plan states that one of the biggest challenges for industry operators is to reconcile development with preservation of environment. This is fully applicable to the development of the national electricity sector. In Senegal, electrical installations are divided into two categories:

Category 1 Includes projects dealing with generation or supply extension of hydroelectric and thermal energy. A comprehensive EIA is required for these undertakings.

Category 2 Includes the following projects requiring initial environmental analysis:

- Electric power transmission lines
- Renewable energy (other than hydroelectric dams)
- Rural electrification
- Energy efficiency and energy conservation

Senegalese norms for effluent discharge in air and water impose a level of performance for stationary combustion engines for electricity generation using Diesel engines and gas turbines. Corresponding threshold values are indicated in tables 3.16 and 3.17 that follow.

Table 3.16: Emission Threshold Values for Diesel Engines

Substance	Heavy Fuel Oil	Diesel (DO)
CO	650 mg/Nm^3	450 mg/Nm^3
NO_x	2 000 mg/Nm^3	165 mg/Nm^3
SO_2	2 000 mg/m^3	
Poussière	100 mg/Nm^3	50 mg/Nm^3

Note: Threshold values correspond to 5 percent (% vol.) content of oxygen in gaseous discharge.

Table 3.17: Emission Threshold Values for Gas Turbines Using Diesel Oil

Substance	Thermal Capacity	
	> 40 MW	**< 40 MW**
CO	450 mg/Nm^3	250 mg Nm^3
NO_x	165 mg/Nm^3	680mg/Nm^3
SO_2	680mg/Nm^3	680mg/Nm^3

Note: Threshold values correspond to operation at nominal rate with 15 percent (% vol.) content of oxygen in gaseous discharge.

The soot index is used with respect to quantify allowable quantities of emitted **soot**. The index is defined as “degree of blackening of a paper filter by gaseous emissions. Comparative scale used to determine the soot index (according to Bacharach method) has 10 degrees from 0 to 9”.

Discharge of soot in thermal installations for electricity generation must not exceed the following indices:

Installed Capacity	Index
Inferior or equal to 20 MW	4
Superior to 20 MW	2

Heaters used in power stations are subject to emission standards depending on the thermal capacity as indicated below (mg/Nm^3):

Substance mg/Nm^3	20 MWTH ≤ Thermal Capacity < 50 MWTH							
	Fuel							
	Natural gas	LNG	Coke gas	FH* gas	Fuel oil	Liquid fuel	Solid fuel	Biomass
SO_2	35	5	800	800	175	1 700	2 000	200
NO_X	180	200	200	200	200	600	600	600
Particles	5	5	10	10	50	100	75	50
CO	100	100	250	250	100	100	200	200

Substance mg/Nm^3	50MWTH ≤ Thermal Capacity < 100MWTH						
	Fuel						
	Natural gas	LNG	Coke gas	FH* gas	Liquid fuel	Solid fuel	Biomass
SO_2	35	5	800	800	1700	2000	200
NO_X	180	200	200	200	400	400	400
Particles	5	5	10	10	50	50	50
CO	100	100	250	250	100	200	200

Substance mg/Nm^3	100MWTH ≤ Thermal Capacity < 300MWTH						
	Fuel						
	Natural gas	LNG	Coke gas	FH* gas	Liquid fuel	Solid fuel	Biomass
SO_2	35	5	800	800	1700	2400-4P*	200
NO_X	180	200	200	200	200	200	300
Particles	5	5	10	10	50	50	50
CO	100	100	250	250	100	200	200

* Plafonné à 1 700mg/Nm^3

Substance mg/Nm^3	300MWTH ≤ Thermal Capacity < 500MWTH						
	Fuel						
	Natural gas	LNG	Coke gas	FH* gas	Liquid fuel	Solid fuel	Biomass
SO_2	35	5	800	800	3650-6.5P	1200-2P	200
NO_X	180	200	200	200	200	200	200
Particles	5	5	10	10	50	50	50
CO	100	100	250	250	100	200	200

Substance mg/Nm^3	Thermal Capacity ≥ 500MWTH						
	Fuel						
	Natural gas	LNG	Coke gas	FH* gas	Liquid fuel	Solid fuel	Biomass
SO_2	35	5	800	800	400	200	200
NO_X	180	200	200	200	200	200	200
Particles	5	5	10	10	50	50	50
CO	100	100	250	250	100	200	200

* Fluorinated hydrocarbon

With respect to surface waters, norm NS 05-061 defines threshold values for effluent discharge as a function of the maximum daily flow. When maximum authorized daily flow surpasses 1/10th of nominal watercourse flow or is superior to 100 m^3 per day, both a limit on a daily flow monthly average value and an instantaneous value limit are fixed.

Depending on the daily maximum authorized flow, residual water discharged into natural environment must not exceed the following threshold values:

Substance	Limit Value
TSS	50 mg/l
BOD_5 (Non-decanted effluent discharge)	80 mg/l, if maximum authorised daily flow does not exceed 30 kg/day 40 mg/l above that level
COD	200 mg/l, if maximum authorised daily flow does not exceed 100 kg/day 100 mg/l above that level
Total hydrocarbons	15 mg/l, if discharge exceeds 150 g/day

Temperature of the effluent discharge must be below 30°C and its pH must be between 5.5 and 9.5. In cases when the temperature of the receiving medium is superior to 30°C, the tolerated a difference of 5°C is admissible for the effluent discharge.

The difference in colour between receiving medium and the mixture, measures at a point representative for the interface area must not exceed 100 mg Co Pt/l.

Specific provisions apply to receiving waters in protected sensitive areas. The effluent discharge measured under normal conditions must respect the following requirements:

- Not to cause temperature increase of more than 3°C;
- Maintain pH between 6 and 9;
- Not to cause increase of more than 30 % in total suspended solids and a variation of more than 10 % in salinity of the waters used for shellfish farming.

Senegal does not have sector guidelines although a guide for electricity generation projects is currently under preparation by the DECE. The national electric power utility, **SENELEC,** uses methods and procedures of international financing institutions in cases when projects are financed with their help.

For self-financed projects, the company's experts follow national environmental procedures (currently, such projects include a 175 km 225 kV interconnection line Tobéne – Touba – Kaolack and a 48 km 90 kV line between Sococim and M'bour). While this is a new procedure, the utility has started to seriously engage itself in the environmental management process.

At SENELEC, the *Direction de la Planification et de l'Equipement* bears responsibility for environmental monitoring of development projects.

IV. Senegal Legal References

1. Norme sénégalaise NS 05-062. Pollution atmosphérique : Normes de rejets. Décembre 2004.
2. Norme sénégalaise NS 05-061. Eaux usées : Normes de rejets. Juillet 2001.
3. Circulaire N° 009/PM/SGG/SP du 30 juillet 2001 concernant l'application des dispositions du Code de l'Environnement relatives aux études d'impact sur l'Environnement.
4. Arrêté No 009468 du 28 novembre 2001 portant réglementation de la participation du public à l'étude d'impact environnemental.
5. Arrêté No 009469 du 28 novembre 2001 portant organisation et fonctionnement du Comité Technique.
6. Arrêté No 009470 du 28 novembre 2001 fixant les conditions de délivrance de l'agrément pour l'exercice des activités relatives aux Etudes d'Impact sur l'Environnement.
7. Arrêté No 009471 du 28 novembre 2001 portant contenu des Termes de Références des études d'impact.
8. Arrêté No 009472 du 28 novembre 2001 portant Contenu du Rapport de l'Etude d'Impact Environnemental.
9. Décret No 2001 – 282 du 12 avril 2001 portant application du code de l'environnement.
10. Loi No 2001 – 01 du 15 janvier 2001 portant code de l'environnement.
11. Plan National d'Action pour l'Environnement (PNAE), 1997.
12. Des projets de textes juridiques complétant et précisant les procédures d'EIE en cours de finalisation.

V. Institutions to Contact in Senegal

Ministère de l'Environnement et de la Protection de la Nature
Direction de l'Environnement et des Etablissements Classés
106, rue Carnot
BP 6557 Dakar Etoile
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Fax: (+221) 822 62 12

SENELEC
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SIERRA LEONE

I. Legal and Regulatory Framework

Sierra Leone is presently faced with the problem of environmental degradation, arising mainly from demographic, economic and social pressures. Rapid depletion of forest resources is one of the major concerns as over 95% of population depend on fuel wood as their main source of energy. Air and noise pollution are not yet a serious environmental problem in the country but there are growing concerns about the effects of smoke emissions from motor vehicles and burned wood and the stench from poorly treated waste disposal sites.

Sierra Leonean people have recognized the importance of sound environmental management in order to safeguard the health and well being of all persons living in Sierra Leone. In year 2000 the nation adopted its **Environment Protection Act (EPA)**. The Act established some structures to oversee environmental affairs. These include the **National Environment Protection Board (NEPB)** hereinafter referred to as "the Board", and the **Environment Protection Department (EPD)**.

The NEPB is composed of a chairperson and 12 members. Among others, the Board's duties include the following:

- To facilitate coordination, cooperation and collaboration among Government Ministries, local authorities and other governmental agencies in all areas relating to environmental protection;
- To review national and sectoral environmental policies and make recommendations or proposals to the Minister;
- To review environmental impact assessments prepared pursuant to this Act and make appropriate recommendations to the Director of Environment.

The EPD serves as the Secretariat to the Board and is in charge of "promoting the formulation of national environmental goals and strategies, and monitoring of the implementation of environmental policies, programmes and projects, standards and regulations."

The Act also defines the role of the **Lead Sectoral Ministry (LSM)** in the EIA process. It specifically states that as a Government body vested with the power and responsibility for issuing a specific permit or licence to proceed with a proposed project, the sectoral Ministry plays an essential role in the smooth and successful implementation of the EIA. However, in cases where an EIA is required, the LSM does not have the authority to grant a license prior to the granting of environmental approval.

The Act includes a provision for the establishment of national environmental standards for emissions into air and water and noise control but such norms still need to be elaborated.

II. The EIA Process

It is through the Environment Protection Act 2000, Part III, and Sections 14 – 19 in particular, that the foundations for use of Environmental Impact Assessment for management are spelt out in Sierra Leone. The EIA is defined as a formal process used to predict the environmental consequences of a proposed development project.

The EIA process is formalized by the EIA Procedures of the Ministry of Lands, Housing, Country Planning and the Environment issued in July 1999. The purpose of this document is to outline the EIA operational procedures of Sierra Leone and to systematically guide all those involved. It aims to provide sufficient information on the EIA process in Sierra Leone in order to facilitate the incorporation of environmental management into project design and planning and also to assist Government in implementing the law as stipulated by the EPA.

In the context of EIA, the National Environment Protection Board and the Environment Protection Department of have the responsibility for co-ordinating, administering and supervising the process. This includes screening and scoping, reviewing environmental impact statements, decision-making and involvement of the public at the various stages of the process.

The First Schedule of the Environment Protection Act provides a list of projects requiring an **environmental impact assessment licence**. Article 14(1) specifies that "no person shall undertake or cause to be undertaken any of the projects set out in the First Schedule unless he holds a valid licence in respect of such project."

An application for a licence is made to the Director of Environment and accompanied by a description of the proposed project. According to Article 16, "the Director shall within 14 days of receiving an application and after consultation with the Board decide whether an environmental impact assessment is required with respect of the project."

The Second Schedule[9] defines criteria used for deciding whether an EIA should be carried out or not and takes into consideration such factors as the scale of the project, its location, extent of the impact on the community and the ecosystem, and cumulative impacts together with other activities or projects.

If a decision has been taken that an EIA is not required, the Director shall issue a licence to the applicant. Otherwise, an applicant is required to prepare and submit an environmental impact assessment of the proposed project to the Director.

The major steps for carrying out EIA are described below whereas the administrative flow of the EIA process in Sierra Leone is illustrated in Figure 3.8.

Screening

Screening is done with the help of standardized "Screening Forms" available at various government Ministries. This is a project brief containing basic and preliminary information provided by the developer in order to determine the likelihood that the project will have negative environmental impacts.

Some projects, such as a nuclear power plant, will automatically require an environmental impact study because, based on experience and the nature of the project, the risk of negative impact is great. On the other hand, it may be clear from the initial screening that a project will not have, negative impacts and therefore, the developer will not be required to undertake an environmental impact study. In this way, resources are most effectively directed to areas with the greatest need, rather than applying the same treatment to all cases, regardless of the specifics or severity of the case.

Where additional information is required, the initial screening may indicate that such information be provided in order to determine whether or not a full EIA study is

[9] The text of the Second Schedule is given for reference in its entirety in Section 4 (Box 4.3.)

necessary. Thus, as a result of the screening process, the projects are classified in the following manner:

Class A: Full Environmental Impact Assessment Required – If a project has significant negative impact on the environment; it will be required that an environmental impact assessment be made in accordance with the existing provisions.

Class B: Additional Information Necessary – In cases where doubts remain as to the significance of potential impacts on the environment, further information is required. Projects falling into Class B will be required to provide additional information before a decision on classification can be made. In this case, the Agency will give the project proponent, in writing, a clear indication of the information that needs to be provided. The Executive Director reserves the right to determine what additional information is required.

Class C: No full Environmental Impact Assessment Required – A project may be categorized as Class C if it is determined that the proposed project will have no significant or adverse impact on the environment, the Director may grant environmental approval to the project without further analysis.

Routine project types (projects that have been adequately assessed in the past) may be exempted from a full EIA. In this case, the EPD will notify the developer and advise on the appropriate environmental management measures.

Scoping

Once adverse negative impacts have been identified, the scope of the environmental impact study will be determined by the EIA Working Group, Government administrators and the developer. The intention of the scoping process is to ensure that all of the questions are answered during the investigation and that the issues to be addressed in the study are the most critical.

The end result of the scoping phase is the **Terms of Reference** (TOR) for the environmental impact study. The approved TOR shall be handed out in writing to the developer who shall at his/her own cost conduct the environmental impacts study and prepare and submit the draft statement accordingly. The TOR will be submitted to the developer within 20 days after the Working Group meeting. The developer will be informed in the case of extraordinary delays.

Environmental Impact Study

Once the TOR have been defined, the developer convenes his/her team to conduct the environmental impact study. The developer bears the full cost of the study. It is the primary responsibility of the developer to stipulate the time frame for completion of the study. The results of the study are compiled and presented to the EPD. This report is called the **Draft Environmental Impact Statement (Draft Statement)**; it evaluates the expected impacts, discusses and evaluates alternative approaches, and provides recommendations for mitigating measures.

In particular, an EIA report must include information specified in the EPA Third Schedule, which postulates that an EIA “shall contain a true statement and description of:

(a) The location of the project and its surroundings;

(b) The principle, concept and purpose of the project;

(c) The direct or indirect effects that the project is likely to have on the environment;

(d) The social, economic and cultural effects the project is likely to have on people and society;

(e) The communities, interested parties and Government ministries consulted;

(f) Any actions and measures which may help to avoid, prevent, change, mitigate or remedy the likely effect on people and society;

(g) Any alternatives to the proposed project;

(h) Natural resources in the locality to be used on the project;

(i) The plans for decommissioning of the project;

(j) Such other information as may be necessary for a project review of the potential environmental impact of the project."

Review of Draft Statement

The Environment Protection Department, as well as affected and interested parties, including members of the EIA Working Group, review the Draft Statement. The Director at the EPD initially reviews the Draft Statement and if satisfied with its scope asks the developer to forward additional copies to members of the/ EIA Working Group and to other persons and places specified by the Director. Thus, the Statement is circulated to the professional bodies, associations, Government Ministries or NGOs for their comments.[10]

In order to open the EIA for public inspection and comments, the Director gives notice of the study in the press. Comments of the interested parties can be submitted to the Director within 14 days of the last publication.

All the recipients of the draft statement and members of the public who consulted the document shall forward their comments, preferably written, to the Director within 30 days after the developer has distributed it. Following this, the Director will study all the comments received and prepare a Review Report, which shall be sent to the Working Group prior to its subsequent meeting for consideration.

The Board convenes the EIA Working Group, the developer and other affected and interest parties at the end of the review period to consider the comments and observations of the working group and decide to grant or deny environmental approval.

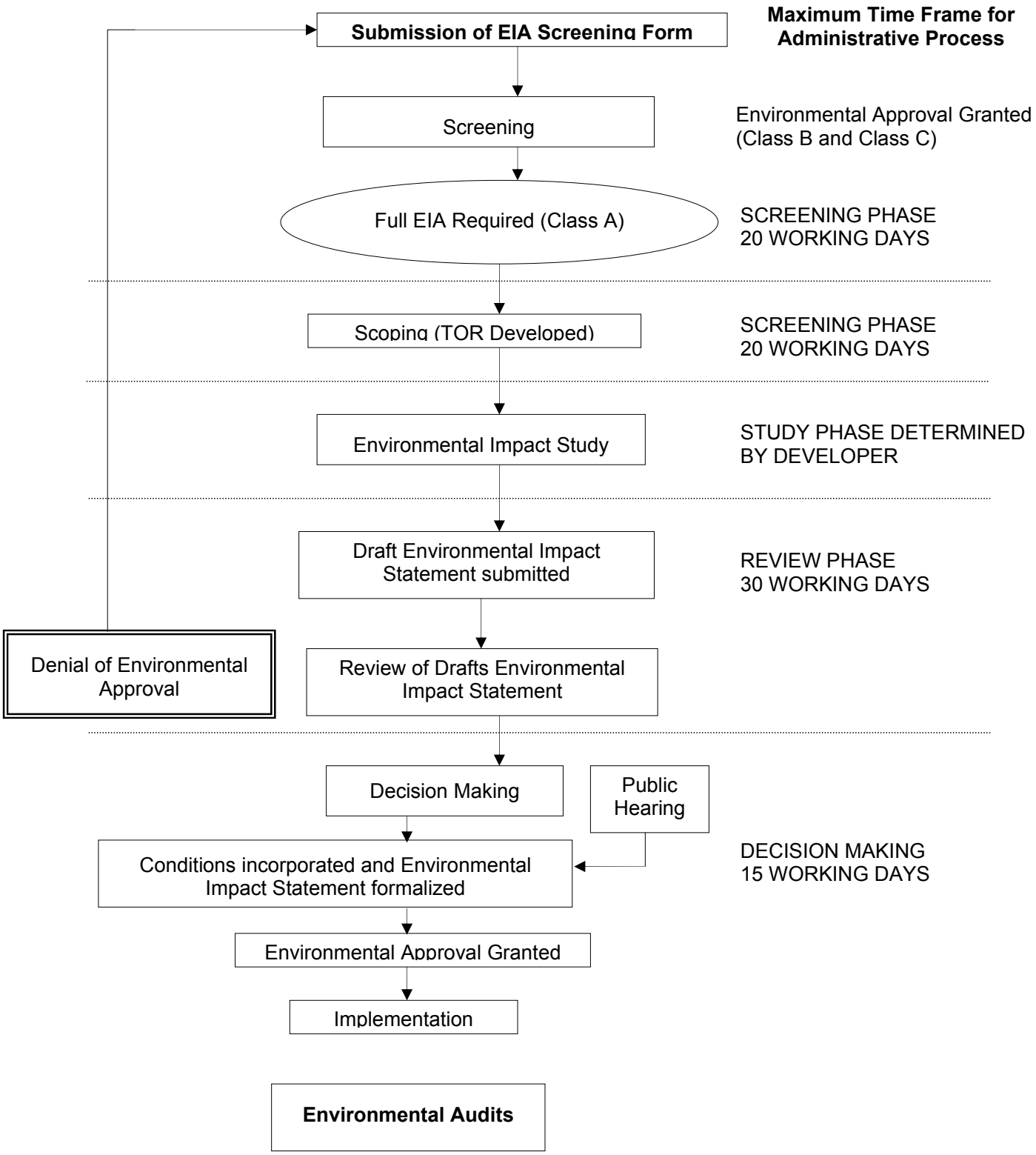
The EIA officer of the EPD will then convey to the Director the minutes and recommendations of this meeting to assent to. He/she shall act upon the recommendations and inform the developer on his/her decision within 15 days. In any case, the entire review process may not exceed 90 days.

A public hearing may be desirable where there is sufficient public opposition to a proposed project. The developer may also choose to convene a public hearing. In the event that a public hearing is required, the Board will appoint a mediator. The EPD will however co-ordinate the public hearing. The findings and conclusions of the public hearing will be recorded for the consideration of the Working Group at its subsequent meeting. The EPD will record the decision of the Working Group, and prepare the formal response to the developer and a copy to the lead department. In the event that the Director deems public hearing necessary, the commenting period may be extended beyond the standard 90 days.

With approval of the Board, the Director issues a licence, which is valid for twelve months from the date of issue and needs to be renewed by the Director.

[10] The total number of copies to submit may not exceed 15.

Figure 3.8: The EIA Process in Sierra Leone



Approval may be granted with or without conditions. In the event that all items in the Draft Statement are accepted and considered environmentally sound, the proposed project is accepted without the addition of conditions. However, in some cases, it may be determined that the environmental approval is granted only if specified conditions are met. The conditions (if any) and the environmental approval will be incorporated into the Draft Statement.

Auditing

The developer, the Government, and the public all have a role to play in auditing in order to ensure that the project is carried out in compliance with the conditions of approval. The developer must monitor project activities to ensure that there are no unanticipated environmental impacts and that they are complying with any and all conditions stipulated in the environmental approval. The Government is mandated to carry out periodic audits of all projects to ensure conformity with the requirements. Lastly, the public has a role to play in monitoring the environment and serving as a "public watchdog" to make sure that projects they come in contact with are not polluting or harming the environment in any way.

III. Implications for the Electricity Sector

In Sierra Leone, the list of projects related to electricity industry and requiring an EIA licence includes those dealing with:

- Exploitation of hydraulic resources
- Infrastructure, including electric power transmission lines
- Industrial activities, including electric power plants

The **National Power Authority (NPA)** of Sierra Leone is aware of the environmental impact of its activities linked mostly to the problem of storing and processing oily sludge produced by its thermal generation units. The Kingtom Power Station is located about one hundred meters from the coastal line of Freetown and operates four main thermal plants as base load engines, which rely mainly on marine fuel oil for their operations. Like most fuel products from crude oil, HFO produces combustion residues and water resulting in sludge. The sludge production varies from one source of the crude oil to the other. The sludge contained in the raw fuel supplied to NPA is removed by centrifuge separation equipment, which dumps about five percent of the total quantity of raw fuel fed into it.

Sample tests carried out on the raw marine fuel supplied by the oil companies revealed a very high water content in the sludge. The high water level makes it difficult to reclaim usable fuel with a separation method.

Each month, while using the existing sludge separation system, the power station generates sludge in quantities as shown below:

Marine Fuel Oil Component	Cubic Meters	% / Raw Fuel
Average total raw fuel supplied for operations	1,983	-
Quantity of sludge separated from the fuel supplied	99	5
Engines actual fuel consumption in the month	1,860	93.8
Total fuel lost due to leaks and other operations related activities	24	1.2
Total quantity of clean fuel lost due to leakage and sludge accumulated in the month	**123**	

In addition to this total quantity of sludge and water, spilled lubricants, diesel fuel used for cleaning and other cleaning agents are disposed of through the same facilities as the sludge.

The combined sludge and lost clean fuel are directed through specially dug up channels where they are mixed with used water from the power station facilities. The water then serves as a transporting medium for moving the oily sludge to an open pit outside the powerhouse, where it is schemed and then pumped into a sludge storage tank located in the courtyard of the power station. The water from the scheming plant, which is free of oil, is wasted into the sea.

The Authority utilizes two storage tanks with nominal capacity of 407,000 IG each, presently filled with sludge accumulated over the years. Of the two storage tanks one is located in one of the authority's facilities outside the power station's premises. The Authority transports the sludge from the storage tank in the power station to the outside storage facility using a fuel hauler at an additional cost to the Authority.

It is estimated that it takes about 25 months of the plants operation to fill up the two sludge tanks. As a means of preventing the sludge accumulation, the Authority initially designed furnaces to incinerate the sludge on a regular basis. This process was abandoned over concerns of the emission of hazardous gases into atmosphere.

Presently, the Authority uses the following measures to get rid of the sludge accumulated over the past years:

- Issuing sludge free of charge to interested members of the community for use in pit latrines. This happens on a small scale and irregularly.
- Issuing sludge free of charge to small-scale industries and most recently to a Chinese-owned company firing bricks.
- The main focus of the Authority is on reclaiming usable fuel from the stored sludge. This is done using auxiliary fuel facilities of a now redundant diesel generator, consisting of a centrifuge separator and storage tanks. The sludge from the main storage tank is fed into the separator and after a number of cycles the settling water is drained and samples of the recovered fuel are tested to ascertain the quality of the final product.

Despite the aforementioned measures undertaken by the Authority to minimize the environmental hazards associated with sludge, the following challenges still exist:

- The sludge scheming plant consists of an open pit that in the rainy season is subject to inflow of a large quantity of water, which raises the level of the oil over the scheming bar at an alarming rate. With the main storage tanks filled, oil would not be pumped out from the pit and water and oily sludge would then be spilled into the sea.

- The spilling of sludge into the sea causes a serious environmental hazard to marine life and the destruction of the natural ecosystem along the shorelines. Sludge is spilled in the vicinity of the power station which is not only an eye sore but poses a serious health risk to workers and the surrounding ecosystems.

IV. Sierra Leone Legal References

1. Sierra Leone Vision 2025: "Sweet-Salone". Strategies for National Transformation. Government of the Republic of Sierra Leone. Freetown, August 2003.

2. The Environment Protection Act, 2000.

3. Environmental Impact Assessment Procedures. Ministry of Lands, Housing, Country Planning and the Environment. Freetown, July 1999.

V. Institutions to Contact in Sierra Leone

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TOGO

I. Legal and Regulatory Framework

In the Republic of Togo, the environmental situation was significantly aggravated in the 1980s following a period of good economic performance during the previous decade. This brought upon the realisation of the need for better management of environmental problems that might in the medium- and long-term compromise positive results of economic growth, and, consequently, affect the prospects for future generations. In response, the Government created the Ministry of Environment in 1987, adopted national Environmental Code in 1988, and established an environmental action plan in 1990.

The **Constitution** of the IVth Republic awarded in its article 41 to each citizen the right to enjoy a healthy environment and gave the State the duty to protect the environment. This provision is reinforced by article 1 of the **Code of Environment** (Law N° 88-14 dated 3 November 1988), which declares conservation of the environment to be in common interest, and spells out the main principles of environmental management.

However, disturbances caused by the socio-political crisis interrupted all these actions and the process of environmental planning and management was suspended in March 1992. The Ministry of Environment became institutionally unstable with the Minister changing ten times between 1991 and 1996.

In 1995, confronted by persistent environmental problems, the Government revived the process of setting up institutional framework for environmental management. The **National Committee for Environment** *(Comité National de l'Environnement)* was constituted in February 1991 to interact with different public and private institutions and associations. The **Inter-ministerial Commission**, instituted by article 3 of the Environment Code for coordination of environmental activities, was created in December 1996. However, both entities were not properly functional.

The **National Environmental Policy** was adopted on 23 December 1998. Its objective is to promote overall, rational management of environmental issues in order to improve living conditions of the population and facilitate sustainable development. The policy postulates that "for a long time, development options and strategies favoured economic growth to the detriment of rational management of environment. To date, national macro-economic studies integrate neither the costs of measures to prevent or reduce damages caused to environment, nor those of depreciation of natural capital as a consequence of exploitation and utilisation of natural resources." Thus, "effective integration of environmental dimension in the development policies, programmes and projects of all activity sectors" was declared a priority.

The **National Environmental Action Plan – NEAP** *(National d'Action pour l'Environnement - PNAE)* consolidated the National Environmental Policy. The Government adopted the document in June 2001. The Action Plan aims to define and promote an overall strategic framework that would allow for greater integration of environmental concerns and development issues with increased involvement of various sectors as well as preparation and implementation of environmental programmes and projects aiming for improved management of environmental issues.

The actions chosen for implementation within the NEAP have been defined by regional plans and analysis of activities of different national and international development actors. These are priority actions that the country will pursue over 15 years to come. They are inscribed in the **National Programme for Environmental Management**

(Programme National de Gestion de l'Environnement - PNGE) that will be updated on a regular basis in accordance with emerging priorities.

It is also planned to create a national environmental management agency (*Agence Nationale de Gestion de l'Environnement - ANGE)* and a national commission for environment and sustainable development *(Commission Nationale de l'Environnement et du Développement Durable).*

II. The EIA Process

In Togo, the need for environmental impact assessment was established by Law N° 88-14 dated 3 November 1988, which created the Code of Environment, and namely by its articles 22 to 32. However, to date, the country does not possess an administrative procedure for carrying out EIA studies. Nevertheless, the Code has defined the main principles for contents, methodology and procedure to follow for EIA studies of a development project:

1. Analysis of initial state of the site and its environment, identification of environmental components on which implementation of a project could have an impact;
2. Evaluation of expected effects of a project on the above components, human health and other potential hazards;
3. Analysis of the measures proposed by the promoter to eliminate, reduce or mitigate harmful effects on the environment and risks of accidents that might be caused by the project as well as an estimate of associated costs;
4. Identification of other possible parties concerned and explanation of reasons for which the project has been chosen from the viewpoint of protection of environment.

In absence on of national procedures, many projects financed by donors – the World Bank, African Development Bank and European Union – follow environmental guidelines of these institutions.

Suivant les dispositions du décret 2001-203/PR du 19 novembre 2001, portant attributions et organisation du Ministère de l'Environnement et des Ressources Forestières, la Direction de l'Environnement est chargée de « gérer, avec les institutions compétentes, le processus des études d'impact et la délivrance du certificat de conformité environnementale, de contrôler le respect des normes et des standards environnementaux, les prescriptions des autorisations et des certificats de conformité environnementale délivrés par le Ministre, ainsi que la mise en œuvre des programmes de gestion de l'environnement résultant des études d'impact et des audits environnementaux ». Elle tient lieu de Bureau d'EIE aux termes des dispositions de l'article 23 de la Loi portant Code de l'Environnement.

Legal texts national procedure, list of projects and development activities subject to EIA and conditions of public participation are under development by the Directorate of Environment. Various guidelines are being progressively prepared.

III. Implications for the Electricity Sector

A l'instar des activités du pays, celles du secteur de l'énergie sont régies par la législation en vigueur. Les projets du secteur, financés par les bailleurs de fonds, sont soumis à étude d'impact sur l'environnement et gérés conformément à leurs directives environnementales.

In 1998, **Communauté Electrique du Bénin (CEB)**, a power transmission company owned jointly with Togo, created an environmental service employing an environmental expert and a sociologist. The activities of the service were interrupted in 2001 – 2002 and subsequently renewed in 2003. CEB takes an active part in the preparation of EIA studies for such projects as the Adjarala dam and hydroelectric plant and interconnection lines with neighbouring countries – Nigeria and Benin. The company's environmental service currently experiences the following operational difficulties:

- Differing environmental legislations in Benin and Togo.
- Differing reference frameworks used as a basis for EIA procedures from different international financing institutions.
- Disrespect of national requirements by external consultants carrying out EIA studies.

IV. Togo Legal References

1. Accords multilatéraux en matière d'environnement auxquels le Togo est partie.
2. Décret N^{o} 2001 – 203/PR du 19 novembre 2001 portant attributions et organisation du Ministère de l'Environnement et des Ressources Forestières.
3. Plan National d'Action pour l'Environnement, juin 2001.
4. Politique Nationale de l'Environnement, décembre 1998.
5. Loi N^{o} 88 – 14 du 3 novembre 1988 instituant Code de l'Environnement.
6. Décret N^{o} 45-2016 du 1er septembre 1945 réglementant au Togo l'expropriation pour cause d'utilité publique.

V. Institutions to Contact in Togo

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4. THE EIA PROCESS

4.1. The EIA Process Flow for Electric Power Generation & Transmission Systems

The specific EIA process phases, components and activities will be defined by the national or donor environmental requirements (or both), depending on the method of financing chosen for the project. However, most EIAs have a common structure. A generic EIA process adapted to the conditions present in West Africa is shown in Figure 4.1 and detailed in this section.

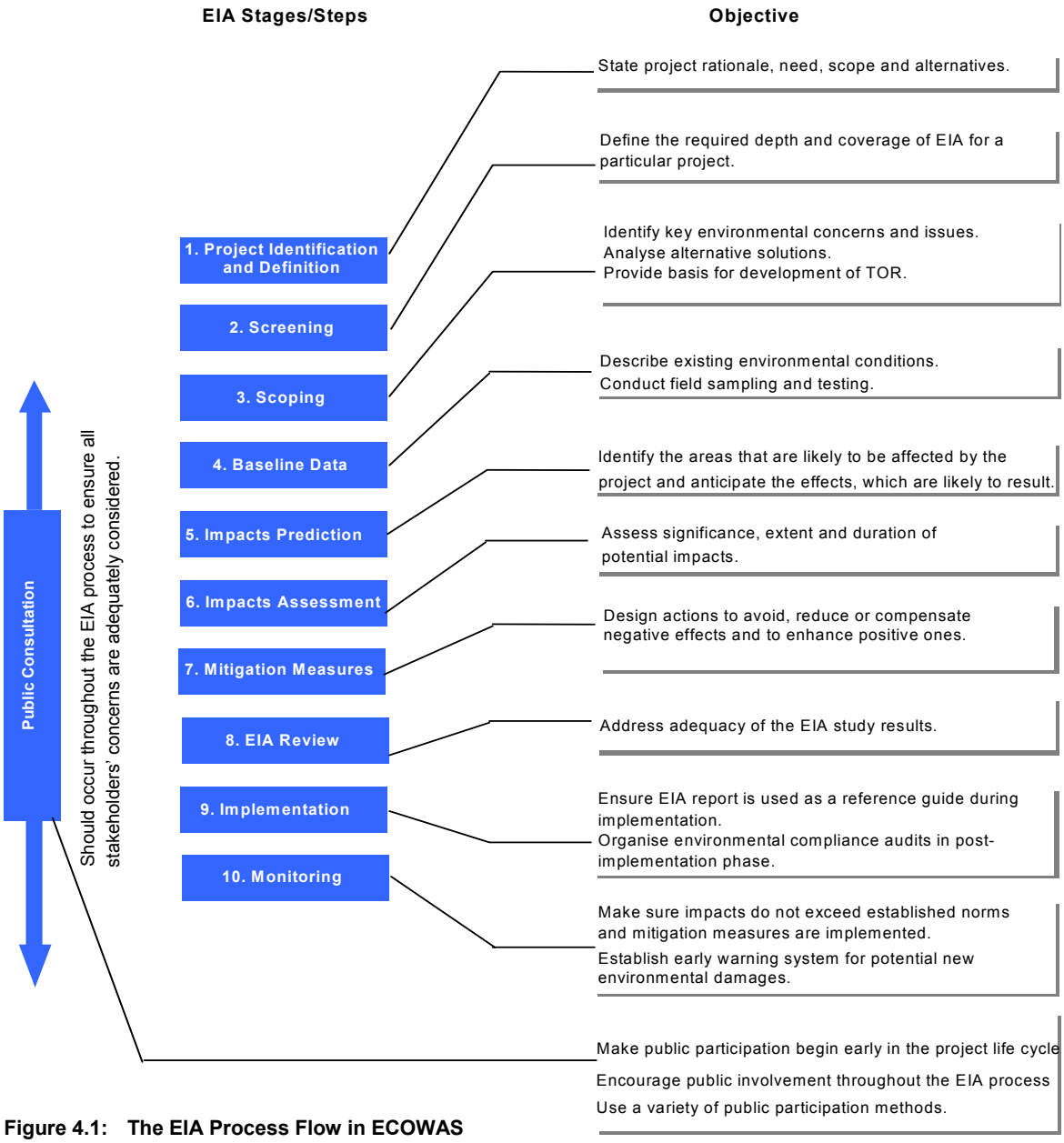


Figure 4.1: The EIA Process Flow in ECOWAS

4.2. Project Identification & Definition

The project identification and definition phase will delineate the spatial and temporal extent of the power project. It will also highlight the projects' key characteristics, peculiarities and objectives.

To correctly define a project, various alternatives must be considered and assessed in a systematic and iterative manner involving technical, environmental, social and economic considerations. All alternatives should be compared in terms of potential impacts, capital and recurrent costs, sustainability under local conditions, and institutional, training and monitoring requirements.

Normally, the EIA process begins with the identification of a need and justification of a project planned to respond to it. A proponent has to convince all the stakeholders that a project is needed and that the particular project choice is justified.

In ECOWAS, the need to accelerate the development of the regional electricity sector is well recognised. The region suffers from a lack of electric power generation and transmission capacity and an absence of region-wide institutional arrangements for power exchange. Furthermore, the very decision to create the WAPP stems from the realisation that the pattern of demand in the ECOWAS region is most economically satisfied through trans-border electricity exchanges.

Experience shows that defining a single-purpose project (such as a transmission line to link two countries) is easier than profiling (and justifying) a project that pursues multiple objectives. Examples of multi-purpose regional projects are the Manantali and Fomi hydroelectric schemes in Mali and Guinea respectively, where damming is used not only to produce electricity but also to provide opportunities for irrigation, fishing and navigation (See Box 4.1).

Box 4.1: Multi-purpose Character of the Fomi Hydroelectric Project in Guinea

The Fomi project in Guinea involves building a dam with a 90 MW plant producing 374 GWh/year. Energy transmission will rely on the construction of two 225kV lines connecting, on one side, Fomi to Bamako (Mali) over 240 km, and on the other side, Fomi to Man (Côte d'Ivoire) over 450 km.

The expected results are income growth, improvement of living conditions of the population, increase in the rate of access to electricity, and modernisation of urban areas. The project will also permit to irrigate 80,000 ha of land in Mali and Guinea and lead to increase in merchandise trade at the port of Conakry, headed for Bamako, via the new navigation possibilities between Kankan and Bamako.

Overall, the project will (i) contribute to fighting poverty; (ii) facilitate de-marginalization of Mali; (iii) improve regulation of the Niger River watercourse (an estimated deficit of 100 m^3/sec.); (iv) create possibilities for exploitation of large gold mining resources in the sub-region; (v) induce greater self-sufficiency of food supply chain.

4.3. Screening (Preliminary EIA)

Once a development project has been defined, it must be subjected to established criteria to determine if an EIA is necessary and to what extent. This process of project categorisation is referred to as "screening". The screening process categorizes project proposals into one of the three following categories:

1. Projects that require a full-scale EIA
2. Projects that require a limited EIA
3. Projects that do not require an EIA

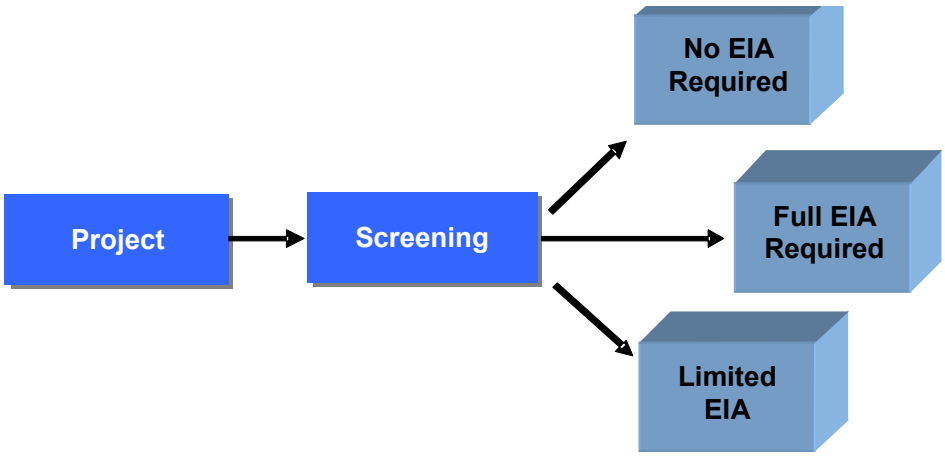


Figure 4.2: The Screening Process

Initial screening is based on evaluation of the gravity of impacts. Sometimes, threshold values are established for key features of the project or its environmental parameters. When the limit value is exceeded, an EIA becomes mandatory. Such thresholds can range from environmental factors such as the size of agricultural land to be acquired to location, cost, output, infrastructure requirements and national standards for air, water and noise. Various checklists and expert judgement are also used to help screen development projects.

Screening should involve government regulatory authorities and should take place as early as possible in the project development cycle so that proponents are aware of their obligations before incurring costs related to project preparation.

Principle of Projects Categorization

The development projects categorization is used to standardize the screening process. The World Bank sets a prime example of using the principle of projects categorization as illustrated in Box 4.2 below.

Box 4.2: The World Bank Environmental Classification of Development Projects

Category A: Projects likely to have significant adverse environmental impacts that are serious (i.e., irreversible, affect vulnerable ethnic minorities, involve involuntary resettlement, or affect cultural heritage sites), diverse, or unprecedented, or that affect an area broader than the sites of facilities subject to physical works. A full EIA is required.

Category B: Projects likely to have adverse environmental impacts that are less significant than those of Category A: few if any of the impacts are likely to be irreversible, are site-specific, and for which mitigation measures can be designed more readily than for Category A projects. Normally, a limited EIA is to be undertaken to identify suitable mitigation and management measures, and incorporate them into the project.

Category C: Projects likely to have minimal or no adverse environmental impacts. No EIA is required.

T
to the EIA of the electricity sector development activities, its Directive 97/11/EC[11] specifies two lists of projects:

Annex 1 lists projects subject to an assessment, namely:

- Thermal power stations and other combustion installations with a heat output of 300 megawatts or more, and nuclear power stations and other nuclear reactors including the dismantling or decommissioning of such power stations or reactors.
- Dams and other installations designed for the holding back or permanent storage of water, where a new or additional amount of water held back or stored exceeds 10 million cubic metres.
- Construction of overhead electrical power lines with a voltage of 220 kV or more and a length of more than 15 km.

Annex 2 enumerates projects for which the Member States shall determine whether the project shall be made subject to an assessment through:

(a) a case-by-case examination, or

(b) thresholds or criteria set by the Member State:

- Industrial installations for the production of electricity, steam and hot water (projects not included in Annex I).
- Industrial installations for carrying gas, steam and hot water; transmission of electrical energy by overhead cables (projects not included in Annex I).
- Installations for hydroelectric energy production.

[11] See Section 2 (2.4.3) for reference.

- Installations for the harnessing of wind power for energy production (wind farms).

In order to improve the screening process and better adapt it to local conditions such West African countries as Benin, Burkina Faso, Gambia, Ghana, Guinea, Mali, Senegal, Sierra Leone and Nigeria introduced pre-defined classes (categories or lists) of projects. In these countries, project categories pre-determine the extent of coverage and depth of the EIA required for particular types of projects

In Burkina Faso, development projects simultaneously fall into one of three distinct categories (A, B or C) and one of three different classes (1 to 3). While categories define the extent of the EIA coverage, the classes impose a minimum distance between a project location and inhabited areas. Therefore, in Burkina Faso, the three project classes effectively establish zoning requirements, i.e. requirements imposing minimum distances between industrial facilities and residential areas.

The existence of the project classification system is exceptionally useful. The absence of it can pose problems for proponents and create an unjustified additional workload for authorities. In the ECOWAS Member States with insufficiently developed environmental legislations the World Bank's projects classification methods are often used for the purposes of development projects screening.

Box 4.3: Factors for Determining whether a Project Requires an Environmental Impact Assessment in Sierra Leone

Second Schedule of the Environmental Protection Act 2000

a) The environmental impact on the community;

b) The location of the project;

c) Whether the project transforms the locality;

d) Whether the project has or is likely to have substantial impact on the ecosystem of the locality;

e) Whether the project results in the diminution of the aesthetic, recreational, scientific, historical, culture or other environmental quality of the locality;

f) Whether the project will endanger any species of flora or fauna or the habitat of the flora or fauna;

g) The scale of the project;

h) The extent of the degradation of the quality of the environment;

i) Whether the project will result in an increase in demand for national resources in the locality;

j) The cumulative impact of the project together with other activities or projects, on the environment.

Screening of Electric Power Projects in ECOWAS region

In the ECOWAS region, most of the new electricity generation and transmission projects will have significant environmental impacts and are subject to a full EIA. Works of minor modification on existing installations, small combustion units or overhead lines pruning might require a limited EIA or none at all. Factors generally used for determining the extent of an EIA that a project might require are summarized in the Second Schedule of the Environmental Protection Plan of Sierra Leone. The full text of the Schedule is shown in Box 4.3.

For the purposes of these Guidelines, based on the experience and existing legislative provisions in the ECOWAS Member States, power and other related projects in West Africa can be ranked according to the magnitude of potential impacts in the following manner:

High Impact

- High voltage transmission lines
- Thermal power generating plants
- Hydropower generating schemes
- Dams and reservoirs
- River basin development
- Large scale land clearing and levelling works
- Resettlement and new land development

Moderate Impact

- Renewable energy
- Rural electrification
- Rehabilitation, maintenance and upgrading projects

Low Impact

- Pruning of overhead lines
- Environmental awareness
- Institutional development

It should be noted that the EIA procedures of some ECOWAS Member States require that projects with less significant effects but located within or close to environmentally sensitive areas be re-classified to the next higher impact category. Schedule 5 of Environmental Assessment Regulations in Ghana provides a detailed description of environmentally sensitive areas (Box 4.4).

Box 4.4: Definition of Environmentally Sensitive Areas in Ghana

Environmental Assessment Regulations, 1999

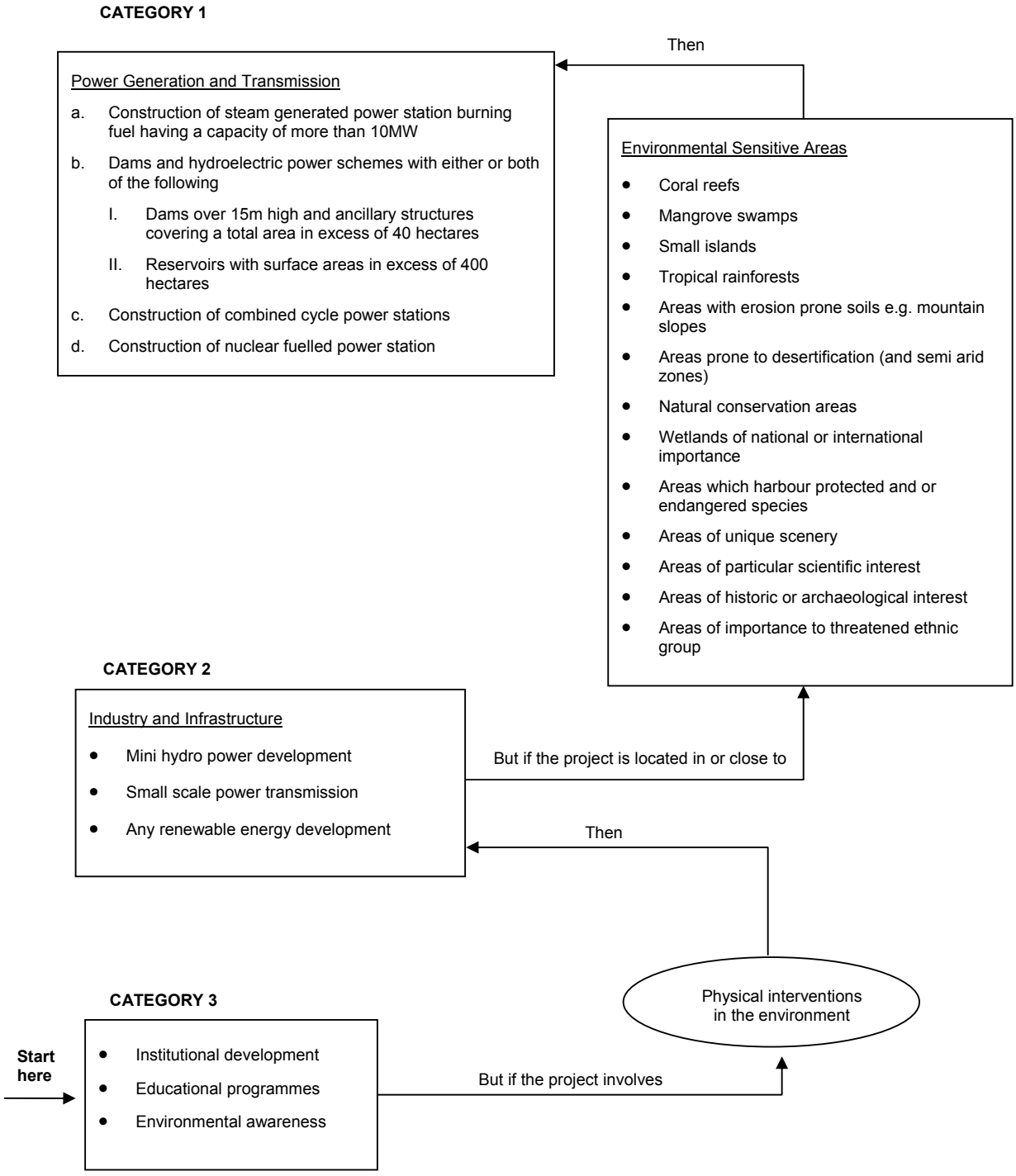
Schedule 5 (Regulation 30 (2))

1. All areas declared by law as national parks, watershed reserves, wildlife reserves and sanctuaries including sacred groves.
2. Areas with potential tourist value.
3. Areas constituting the habitat of any endangered or threatened species of indigenous wildlife (flora and fauna).
4. Areas of unique historic, archaeological or scientific interests.
5. Areas traditionally occupied by cultural communities.
6. Areas prone to natural disasters (geological hazards, floods, rainstorms, earthquakes, landslides, volcanic activity etc.)
7. Areas prone to bushfires.
8. Hilly areas with critical slopes.
9. Areas classified as prime agricultural lands.
10. Recharge areas of aquifers.
11. Water bodies characterized by one or any combination of the following conditions -
    a) Water tapped for domestic purposes;
    b) Water within the controlled and/or protected areas;
    c) Water supporting wildlife and fishery activities.
12. Mangrove areas characterised by one or any combination of the following conditions -
    a) Areas with primary pristine and dense growth;
    b) Areas adjoining mouth of major river system;
    c) Areas near or adjacent to traditional fishing grounds;
    d) Areas acting as natural buffers against shore erosion, strong winds or storm floods.

An example of a checklist for categorization of electric power projects for EIA screening can be found in Nigerian environmental legislation as illustrated in Figure 4.4.

Figure 4.4: Nigerian Checklist for Categorization of Projects for Environmental Screening

(Adapted from the FEPA EIA Procedural Guidelines)



4.4. Scoping

Scoping is carried out to determine the extent of the EIA coverage. Its purpose is to develop and select alternatives and identify the issues to be considered in the EIA. The scoping exercise will:

- Identify the key environmental concerns and issues
- Define project alternatives and options
- Determine the spatial and temporal boundaries for the EIA
- Identify all affected parties and to inform them
- Enable the impacts and alternatives to be considered at different levels
- Elaborate work programme for EIA
- Conclude with the development of the terms of reference (TOR) for the EIA study

Benefits of scoping include:

- Improvement in quality of EIA by identifying and incorporating relevant issues into project planning at an early stage
- Reduction in magnitude, cost, time and size of EIA
- Involvement of stakeholders reduces the chances of prolonged delays and conflicts

Methods of scoping include:

- Review of available EIA reports on similar projects
- Site visits and data validation
- Use of checklists, matrices, networks, overlays, comparative analysis and other methods
- Public participation (through public meetings, networking, open houses, workshops and seminars)

Terms of Reference (TOR)

TORs are prepared to define the precise scope of work for the EIA. From the viewpoint of the regulatory authorities, well-defined TOR are essential for the success of the EIA, as it will ensure that the scope properly addresses the most relevant issues.

The extent of information required for an EIA depends on the type, level, and size of the project. TOR objectives should include:

- Identification of project proponent(s)
- Specification and structuring of appropriate EIA process
- Identification of spatial and temporal parameters of proposed EIA

- Review of relevant local, national and international statutory legislations, conventions, treaty, law and policies
- Provision of adequate background information on the proposal for ease of assessment by stakeholders
- Provision of necessary information for correct evaluation and acceptance of the planned environmental impact assessment

ECOWAS Member States have different rules regarding the presentation of the TOR for EIA studies. The most detailed requirements exist in Gambia, Ghana and Senegal. Section 3 of these Guidelines offers specific country descriptions.

Scoping should not be an isolated exercise. It should continue well into the project planning and design phase, depending on how new issues arise for consideration. It is an opportunity to reconcile wishes of various stakeholders and the time and the means that can reasonably be allocated to the EIA.

4.5. Baseline Data

It is necessary to conduct a comprehensive review of existing information related to the project and its environment. The literature and data review must include a qualitative and quantitative description of the existing bio-physical and socio-economic attributes of the environment.

Existing information should be sourced from environmental agencies, government databases, local universities, industry reports, the World Bank and other IFIs. Additional information can be acquired through field investigations and samplings; field investigation should be designed so that it will capture seasonal variations. Experts with local knowledge in each of the key areas should be involved in the field investigation.

Baseline data provides a detailed description of the existing status of the environment. This enables the benchmarking of predicted changes and new environmental trends with respect to the initial state of environment.

4.5.1. Physical Environment

Climate and Meteorology

Climatic elements of interest include:

- Temperature (minimum and maximum)
- Rainfall (total and distribution)
- Humidity
- Wind speed and rose of winds
- Seasonal patterns
- Cyclic events (i.e., droughts, floods)

The information on these elements should be used to establish unusual conditions of temperature, frequency and extent of temperature inversion, if any, historical patterns of wind flow, unusual conditions of high winds and storms. Sources of data include records from the nearest meteorological station plus similar information collected during field investigations.

Ambient Air Quality and Noise

Existing air conditions in terms of ambient air quality, emission inventories and meteorological information relating to atmospheric dispersion must be identified.

Air quality examination should include particulates, gaseous and odorous compounds, SO_X, NO_X and other major constituents of the air that may be affected by the proposed project.

Also, baseline noise levels should be measured in selected areas that may be affected by the project.

Geology and Topography

The geology of the proposed project area, with particular focus on the physical and chemical properties of surface and sub-surface materials and geological structures must be identified. Detailed topographical map of the area showing significant features of the landscape should be created.

In locations where significant fossil specimens may be uncovered during construction and/or operation, such information should be documented.

Soils

Soils found in the various habitat types in the project area should be identified, characterised and classified with respect to their vulnerability to erosion and subsequent impact on fertility. The type and diversity of soil organisms should also be described. Soil samples should be analysed for:

- pH
- Total hydrocarbons
- Total organic carbons (TOC)
- Trace metals
- Particle size distribution
- Polynuclear aromatic hydrocarbons (PAH)
- Porosity
- Microbiology
- Macrobiology / Soil ecology

Hydrology

The groundwater hydrogeology of the project area should be analysed with emphasis on the potential of existing aquifer and groundwater contamination through leaching, landslides, subsidence or other earth movements. Hydrological studies should include:

- Identification of rivers and streams
- Investigation of the relationship between the surface and subsurface water bodies and their flow directions
- Analysis of flood flows, low flow regimes including seasonal variations, and analysis of drainage patterns
- Groundwater depth to seasonally high/low water table
- Important water uses such as domestic, industrial intakes, recreational, agriculture, fisheries etc.

- Capacity of receiving waters to assimilate effluent
- Surface and groundwater ambient quality:
  - Physical and chemical properties: dissolved oxygen, salinity (as chlorides), total suspended solids, total dissolved solids, turbidity, total hydrocarbon content etc
  - Water chemistry: exchangeable cations (Ca^{2+}, K^{+}, Mg^{2+}, Na^{+})
  - Heavy metals (Fe, Zn, Cr, Cu, Pb)
  - Water microbiology

Surface water studies should provide description of existing surface drainage patterns, flows in major streams and wetlands, records of flooding and analysis of present and potential water use downstream of the project area.

Surface water quality determination should include *in-situ* measurement of salinity, conductivity, turbidity, dissolved oxygen, temperature and surface current of the water bodies adjoining the project area. Water sampling should take into account the surface, mid-depth and bottom strata at designated sample sites, for both high and low tides, where applicable.

Surface water samples should be analysed for:

- Physico-chemical properties including: total organic carbons (TOC), phosphates (PO_3), nitrogen oxides (NO_3), N_2, biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), salinity, chloride (Cl), carbonate (CO_3), hydro carbonate (HCO_3), total dissolved solids (TDS), total suspended solids (TSS) etc.
- Heavy metals
- Total hydrocarbon content (THC) and total petroleum hydrocarbon (TPH)
- Microbiology

In addition, existing water use patterns should be established through a survey questionnaire incorporated in the socio-economic survey of the project area.

4.5.2. Biological Environment

Biological resources should be described in details to create a basis of comparison between the conditions that existed before the project is executed and after the impacts, if any, have become noticeable.

The biological studies should be designed to identify the predominant ecosystems (i.e., forests, wetlands, grasslands, savannas etc). Analysis of the identified ecosystems should include:

- Assessment of the overall condition of the environment according to the degree of degradation, i.e. pristine > slightly disturbed > degraded > heavily degraded.
- Identification of the key elements (species or groups of species) and their role within the ecosystem.

Surveys of flora and fauna should be conducted throughout the year to reflect seasonal variation in communities and to identify migratory species. Special attention needs to be paid to terrestrial and aquatic flora and fauna, sensitive habitats and endangered species.

Terrestrial Flora

Terrestrial vegetation studies should be conducted to identify and describe the dominant habitat types. The vegetation studies should describe the following:

- Characteristics of vegetation types within the proposed area
- Plant and crop pathology and visual health condition of bio-ecology and
- Economic crops (economic crops inventory and evaluation).

The terrestrial vegetation communities within the project areas should be mapped at an appropriate scale (e.g., 1:10,000) using aerial photography and field observations. The map shall include, as a minimum, the following information:

- Location and abundance of plant communities of economic significance.
- The current extent of protected vegetation types of conservation significance within the affected area, e.g. national parks and reserves.

Terrestrial Fauna

Field observations should be carried out within the proposed area to taxonomically identify the animal and wildlife resources within the study area. Visual observations should be supplemented with additional information from interviews and/or focus group discussions involving hunters and farmers from the settlements within the study area.

Both the terrestrial and riparian fauna occurring in the studied areas should be described, noting the broad distribution patterns in relation to vegetation, topography and substrate. The description of the fauna present in the area should include:

- Species diversity (i.e. a species list) and abundance of animals;
- Habitat requirements and sensitivity to changes, including movement corridors and barriers to movement;
- The existence of feral or exotic animals;

- Existence of any rare, threatened or endemic species/communities in the studied area, including discussion of habitat range, breeding and feeding requirements, and
- Use of the area by migratory birds.

Aquatic Biology

A biota surveys should be conducted within and around the project area to describe the aquatic flora and fauna and highlight their patterns and distribution in the waterways and/or associated lacustrine and marine environments.

The description of the fauna and flora present in the area should include:

- Fish species, mammals, reptiles, amphibians, crustaceans and aquatic invertebrates occurring in the waterways within the project area
- Aquatic plants
- Any rare or threatened aquatic species and their habitat
- Habitats that could be affected downstream of the project.

Water column and sediment samples should be collected from identified water bodies and analysed for:

- Plankton (zooplankton and phytoplankton)
- Microbiology
- Benthic in-fauna.

Ecologically Sensitive Habitats

The environmental baseline survey should characterise sensitive areas, which may have low resilience to environmental change. Such areas might include the marine environment and wetlands, mangroves, wildlife breeding or roosting areas, any significant habitat or relevant bird flight paths for migratory species and habitat of threatened plants, animals and communities. The proximity of the proposed project location to any biologically sensitive areas should be noted. The capacity of the area to assimilate discharges/emissions needs to be assessed.

Rare and Endangered Species

The flora and fauna communities, which are considered rare or endangered, should be described. The description should include as a minimum a complete list of animal and plant species.

4.5.3. Socio-cultural Environment

Socio-economic studies (SES) should be carried out in areas within and adjacent the project area, i.e. for the communities likely to be affected by the proposed project. The SES will include description of ethnicities, historic and current governance systems, past and recent conflicts and migratory trends, education, religion, health-care, dominant livelihoods and occupational structure etc.

Ethnic Composition

A description of the ethnic diversities in the affected communities and their demographic and spatial distribution shall be carried out. Emphasis should be made on the study of economic, social, religious or cultural inequalities amongst the various ethnic groups and factors that can potentially result in conflicts and migration.

Past and recent migrations in the affected communities should be described in details. A study on refugee tolerance and acceptance should be carried out as indicated by the number of refugee/non-indigenes that are accommodated peacefully in the community.

Governance

The evolution of the governing systems should be addressed, including existing local institutions and their operation. The distribution of power, both formally and informally, should be well documented. The leadership experience and resistance to change should be studied especially in the ways the community has been able to fit into local and national planning activities. The description should also include analysis of the capability for handling issues and conflict resolution.

Dominant Livelihoods

The demographic patterns of communities in the project area by size, land use, economic activities (with emphasis on low income groups highly dependent on primary activities), labour supply and employment markets, income distribution and consumption patterns should be analysed.

Present income level of people likely to be affected by the project should be documented. Local commerce in the project area in relation to goods and services that are readily available and where they may be obtained need to be fully analysed. Also, the predictable effects resulting from project activities on the demand for goods and services must be addressed.

The land tenures, land use patterns including native title issues, location and owner/custodian of native title claims should be documented. The proposed project's implications on future developments in the area including constraints on surrounding land uses should be described.

The existing social and educational amenities as well as the general attitude of the people in the affected communities towards education should be examined and documented.

The current employment generation schemes in the area and the potential impact of the project on employment and influx of labour must also be carefully studied.

Public Health

Public health depends greatly on the quality of the environmental. For instance, a change in habitat may bring about an increase in disease vectors, or the likelihood of contact between the vectors and humans. Also, there are disease pathways, which occur solely within a specific social context. One example is an increase in incidence of sexually transmitted disease (e.g., HIV/AIDS) resulting from the influx of a construction workforce.

Aspirations and Attitudes

Indigenous and non-indigenous cultural heritage sites, places and values should be identified. These shall include structures and sites of historical, religious, archaeological or architectural significance such as shrines, burial grounds etc. This will enable project proponent identify activities that will likely be acceptable to the communities affected.

The public perception of the planned development activities should be critically assessed.

4.6. Impacts Prediction

The main objective of impacts prediction is to delineate the areas that are likely to be affected by the project implementation. In other words, this activity is concerned with anticipation of the effects, which are likely to result from the project. Where appropriate, the probability of an impact occurrence can be determined scientifically.

Impacts identification should start at the early stages when data on both the project and surrounding environment are made available. As the EIA study progresses and more data becomes available on the environment and the socio-economic conditions, the preliminary identification of impacts from scoping may be confirmed or new impacts identified.

Environmental impacts of economic development projects may be beneficial or adverse. The identified impacts should be described using the available environmental baseline data for the project area. The impacts in the following fields need to be considered:

- Biophysical
- Social
- Economic
- Cultural
- Health

Biophysical Impacts

In order to minimize unfavourable effects of the proposed power project on the biophysical environment, it is necessary to identify the project activities that may affect such biophysical components. At the same time, the biophysical environmental components present in the project area should be carefully analysed. In particular, the following factors shall be taken into account:

- Composition, structure, and abundances of flora, including endangered, rare endemic species and plants of economic value.
- Keystone animals that are important players in food chain must not be affected by the project activities.
- Endangered, rare and endemic species that form important component of biodiversity must not be threatened.

Economic Impacts

Assessment should focus on estimating the economic effects of:

- Project construction and operation
- Workforce requirement and the income earned by workers
- Materials and other inputs for the project
- Capital investment

It is essential to estimate the size of labour force, skilled manpower requirement and the duration of their involvement. An estimate of capital expenditure on local materials and

services is also required for economic evaluation. A thorough analysis of the labour force and the local economy requires information about:

- Categories of labour available
- Categories of labour that are highly demanded and employed, not employed or partly employed
- Estimate of unemployed labour
- Proportion of female population looking for employment
- Number and type of employment opportunities to be generated by the project.

Social Impacts

Assessment of social impacts shall permit to examine the project actions that are likely to affect the existing social conditions in the project zone. This would make it possible to elaborate the appropriate mitigation measures. Social impacts assessment shall include:

- Demographic impacts - such as displacement and relocation effects, and changes in population characteristics
- Institutional impacts - including demands on the government and social service, NGOs housing, schools, criminal justice, health, welfare and recreational activities
- Gender impacts - the implications of development projects on the role of women in society, income-generating opportunities, access to resources, employment opportunities etc.

The analysis should cover the following socio-cultural parameters:

- Quality of life
- Social organization and structures
- Dispute-resolution institutions and processes
- Relationships between generations and value systems

Cultural Impacts

Project impacts on cultural heritage should be considered. Areas of study should include historic sites, religious shrines and other related areas, and traditional practices that may be affected.

Cultural resources refer to archaeological, historical, religious, cultural and aesthetic values and are part of the resource base. It is therefore important that the development option under consideration is screened for potential impacts on cultural resources and UNESCO World Heritage Sites, recognised as having substantial universal value.

Health Impacts

The World Health Organisation (WHO) defines health as “a state of social and individual well-being” and not just the absence of disease. If this view is accepted, then the links between health and social impacts are apparent. Often, health impacts depend to a large extent on environmental impacts. This consideration should be adequately described.

4.7. Impacts Assessment

Once the likely impacts have been identified, their significance must be assessed while taking into consideration their nature, size and other characteristics with respect to all components of the environment that are likely to be affected. Impacts should be described in both quantitative and qualitative terms as follows:

- *Magnitude of Impact*: this defines the severity of each potential impact and indicates whether the impact is irreversible or reversible and estimates the potential rate of recovery. The magnitude of an impact are not considered high if major adverse effects can be mitigated.
- *Extent of Impact*: the spatial extent or the zone of influence of the impact need to be determined. An impact can be site-specific or limited to a specific project area or produce consequences on a national or regional level.
- *Duration of Impact*: environmental impacts have temporal dimensions that should be considered in an EIA: short-, medium- and long-term. Impacts arising at different phases of the project cycle should also be considered.

> **Assessment normally does not mean doing new science, but rather assembling, summarising, organising and interpreting pieces of existing knowledge, and communicating them so that an intelligent but inexpert policy-maker will find them relevant and helpful in their deliberations.** (Munn, 1979)

The primary areas for assessing the significance of impacts are:

(a) Ecological

The criteria relating to ecological importance includes environmental aspects critical to the functioning of the ecosystem:

- Effects on plant and animal habitat
- Rare and endangered species
- Ecosystem resilience, sensitivity, bio-diversity and carrying capacity
- Sustainability of local species populations

(b) Social and Economical

Biophysical impacts are evaluated with respect to factors valued by man. The following concerns influence the perception of environmental value:

- Effects on human health and safety
- Potential loss of farmland
- Potential loss of species with current or potential commercial value
- Recreational or aesthetic value
- Demands on public resources such as social service

- Demands on transportation and other infrastructures
- Demographic effects

(c) Environmental Standards

Environmental standards are criteria designed to contain certain environmental conditions within specified limits believed to be requisite to achieve social, economic, and cultural objectives. Examples are limits on effluent discharge concentrations, ambient air standards, water quality standards etc.

Impact Evaluation Techniques

Significance of impacts should be evaluated using the most appropriate techniques. The chosen evaluation method should be simple and incorporate criteria such as impact magnitude, duration, cause and effect relationships, importance and prevalence in the assessment. It is also necessary to examine whether an impact is reversible or not. In addition, the chosen evaluation method should be easily adaptable to the available data.

To evaluate the significance of impacts, the following impact evaluation techniques can be employed:

- Checklists
- Matrices and networks
- Overlays and Geographic Information Systems (GIS).

Checklists

Such checklists are constituted using exhaustively the knowledge of components of physical and socio-economic environment of the project and past experience with similar projects. They include systematic examination of environmental parameters meant to spot the elements relevant for the analysis of the ambient conditions.

Matrices & Networks

Matrices make use of a two-dimensional table to oppose to each other project activities and the environmental components they are likely to affect. Apart from identification of links between activities and impacts, the method enables to estimate magnitude and extent of the expected impacts appearing in matrix cells.

Matrices can be completed with networked diagrams that show links and interactions between different components of the ecosystem. This helps to bring out cumulative and interactive impacts.

Overlays and Geographic Information Systems (GIS)

The maps are first created in order to develop a spatial vision of main environmental features of the area and the types of impact to expect. Overlaying and correlation of information layers contained in the maps will permit to precisely locate environmentally sensitive zones. This will also provide an opportunity to visualize links between technical components of the project and socio-economic reality of the area. This will facilitate

analysis of possible cumulative impacts and potential interactions between the impacts with different sources/targets.

Overlays can be created manually for a small project. For large-scale projects, Geographic Information Systems (GIS) are used to allowing to overlay various feature maps using the exhaustive data referenced geographically (geometrically and alphanumerically). The GIS can also use the specialised databases available for global and local applications. Information obtained during investigations in the project area can be added to complete the research.

To objectively screen the issues and determine the significance of the impacts, the general significance criteria shown in Table 4.1 should be used. These significance criteria are to be applied to all potential impacts to determine whether they are negligible, minor, moderate or major.

The issues found to be negligible (or not applicable), based on the significance criteria, should be eliminated from (or "screened out" of) further consideration. Those issues not clearly negligible that pass the screening, should then be evaluated in more detail, and rated as negligible, minor, moderate, or major impacts. The use of the significance criteria to screen and evaluate impacts enables the EIA to systematically identify and focus on those resources most likely to be impacted by the proposed project activities.

It is important to remember that similar impacts will lead to loss of more value in environmentally sensitive areas.

Equally, the significance of impacts will increase in non-sensitive regions with increase in the extent of the affected area.

Table 4.1: Impact Significance Criteria

Impact Level	Natural Impact
Negligible	• Little or no change in natural environment, effects are barely measurable above background conditions. Measurable effects are very temporary (a few days or less) before complete recovery.
Minor	• Localised, relatively isolated change in natural environment, lasting only from few days to few months before recovery, with no observable residual effects. • Area extent only up to a total of 0.5 square kilometres.
Moderate	• Local modification of considerable severity in atmospheric, surface or subsurface conditions, lasting from few months to two years before recovery. • Extent of affected area from 0.5 to 5.0 square kilometres, or widespread modification of lesser severity.
Major	• Widespread modification of considerable severity; area extent of impact is over 5 square kilometres.
Impact Level	**Socio-economic Impact**
Negligible	• Little or no change in socio-economic conditions or commercial activities (e.g., fishing), effects are barely measurable above background conditions, much less significant than periodic stress by on-going socio-economic and commercial activities. • Measurable effects are very temporary (a few days or less).
Minor	• Localised, relatively isolated change in socio-economic conditions or commercial activities, lasting only few days to few months, with no observable residual effects.
Moderate	• Local modification of considerable severity with less than 10 percent of population affected by change in socio-economic conditions or commercial activities in the baseline area, lasting from few months to two years. • Widespread modification with more than 50 percent of individuals affected by change in socio-economic conditions or commercial activities in the baseline area.
Major	• Widespread modification of considerable severity in socio-economic conditions and commercial activities, lasting over two years.

4.8. Mitigation Measures

Mitigation measures should be recommended to reduce, avoid or offset the potential adverse environmental consequences of the proposed development activities. The objective of mitigation measures is to maximise project benefits and minimise undesirable impacts.

Mitigation measures should be preventive, compensatory or corrective in nature.

Table 4.2: Types of Mitigation

Preventive	Prevent or reduce potential adverse effects prior to occurrence, e.g., public awareness program, health education program.
Compensatory	Actions that compensate unavoidable adverse effects, e.g. restoration of damaged resources, creation of similar resources or habitats to replace a lost one, and compensation paid to affected persons.
Corrective	Applied to reduce the adverse effects to the acceptable level, e.g. installation of anti-pollution devices, construction of fish ladders (in dams, weirs).

If population resettlement is inevitable, a compensation and resettlement plan needs to be established at an early stage and the associated costs integrated into the total investment value.

Mitigation should be monitored for adequacy throughout the process. When new types of impacts are identified, new mitigation measures must be proposed to address them.

Experience in West Africa shows that the cost of mitigation measures can be easily underestimated. It is especially difficult to take into account unpredicted or new impacts. In order to avoid unsustainable implementation or subsequent project failure, EIA authorities must emphasize to developers the need for thorough consideration of such costs when performing feasibility studies of projects. Such costs are normally at the level of 3% to 5% of the total project cost and can go up to 10 per cent if population resettlement is involved.[12]

[12] World Bank's estimate.

4.9. EIA Review

EIA reviews should be undertaken to ascertain the correctness and adequacy of information provided in the EIA report for decision-making. EIAs should be reviewed internally by the project proponent and externally by government agencies, expert groups, NGOs and the general public. The review should be conducted to:

- Assess the quality of the EIA report
- Determine if the information provided is sufficient
- Identify any deficiencies to be corrected
- Incorporate public comments

The terms of reference, prevailing EIA guidelines and existing EIA report of similar projects should be used to judge the adequacy of the EIA report. In reviewing the EIA document, the following questions should be considered:

- Does it comply with the TOR?
- Is there a complete and satisfactory statement of key issues?
- Is the information provided relevant, correct and technically appropriate?
- Are public comments incorporated?
- Is the information provided sufficient for decision-making?

Copies of the draft EIA report should be submitted to the regulatory agency for review. In general, the following should be taken into consideration for reporting:

Layout

The report outline should be as stated in the TOR. The national statutory documents in Benin, Burkina Faso, Côte d'Ivoire, Gambia, Ghana, Mali, Nigeria, Senegal and Sierra Leone impose minimum contents and recommend a structure for EIA reports. Respective country requirements are detailed in Section 3 of these Guidelines.

The layout of the report enables the reader to find and digest information easily and quickly. There should be a brief introduction describing the project, the aims of the environmental assessment and how those aims were achieved.

Information would be logically arranged in sections or chapters and the whereabouts of important data would be signalled in a table of contents.

When data, conclusions or quality standards from external sources are introduced, the original source must be acknowledged.

Presentation

Care should be taken in the presentation of information to make sure it can be easily understood:

- Information must be presented so it is comprehensible to the non-specialist. Tables, graphs and other illustrations should be used as appropriate. Unnecessarily technical terms should be avoided.

- Technical terms, acronyms and initials should be defined, either when first introduced into the text or in a glossary.
- Data presented in appendices should have been fully discussed in the main body of the text.
- Information should be presented without bias and according to its importance within the context of the study. Prominence and importance should be given to severe adverse and beneficial impacts.

Non-technical Executive Summary

A non-technical summary shall be part of the study report. It should contain at minimum the following information:

- A brief description of the project and its environment
- A brief explanation of the methods by which the data was obtained and an indication of its reliability
- Description of the main conclusions and describing how they were arrived at. It should contain at least

Technical terms, lists of data and detailed explanations of scientific reasoning should be avoided.

The review process should aim to:

Step 1: Identify the deficiencies

Step 2: Focus on critical shortcomings

Step 3: Recommend remedial actions

4.10. Implementation

At this phase of the project cycle, the EIA report will act as a "reference guide" for the implementation of mitigation strategies and monitoring schemes. Thus, the usefulness of an EIA report does not end with its official approval. It serves as a basis for the environmental management plan and will help to implement the project.

Implementation begins with the construction phase. While planning the construction activities, it will be necessary to:

- Include environmental requirements in the tender document for the project construction,
- Include environmental control and monitoring activities in the work progress schedule and make provision for the associated costs.

Lastly, after the project is completed, an "audit" can be done to determine how close the EIA predictions were to the actual impacts of the project. This forms valuable records for other EIAs of similar projects in the future.

4.11. Monitoring

Environmental monitoring is an activity undertaken to provide stakeholders with specific information on the evolution of the environmental and social variables over a period of time. Environmental monitoring and periodic auditing should be undertaken in order to:

- Ensure that impacts do not exceed the legal standards
- Check that the mitigation measures are implemented in the manner described in the EIA report and are efficient
- Inform and reassure the stakeholders with respect to the effective and efficient implementation of the mitigation measures
- Provide early warning of potential new environmental damages

The main aim of EIA monitoring is to provide the information required to ensure that project implementation has the least possible negative impacts on the people and ecology. Interruptions in monitoring process may result in insufficient data to draw accurate conclusions concerning the project's impact. EIA monitoring implementation is planned with the help of a project-specific **Environmental Management Plan (EMP)**.

A well-defined environmental management plan has to be developed prior to project commencement to test, verify and enforce the effectiveness of the proposed mitigation measures outlined in the EIS. The information obtained for the programme should then be presented in a monitoring report.

An EMP will typically describe anticipated environmental impacts, mitigation measures or compensatory measures where mitigation measures are not possible, institutional arrangements for mitigation and monitoring process control, implementation schedule, reporting procedures, cost estimates and source of funding.

Control of the EMP implementation should be the responsibility of the government agency in charge of enforcement of environmental legislation. Self-monitoring by proponents during implementation is also important. Normally, this should be reflected in the reporting requirements of the regulatory authorities.

Regulatory authorities need to ensure that the monitoring programme adequately addresses all environmental concerns and that adequate resources are available to carry out the programme effectively and efficiently. This is important, as the whole point of the EIA will be compromised if there are no means of verifying that the mitigation measures have actually addressed the identified negative impacts.

The EIA monitoring report should be organised in a well-developed format and allow for easy presentation at decision-making and review meetings. Regulatory agencies should enforce the decisions taken in the review meetings. If decisions are not implemented, legal measures should be initiated to ensure compliance.

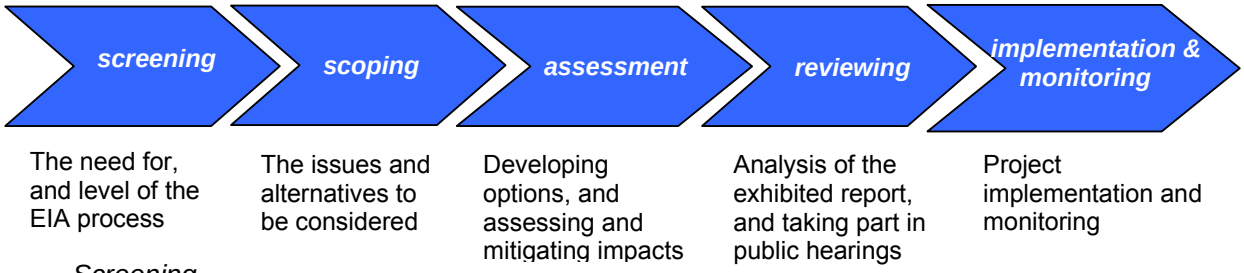
4.12. Public Participation

Project proponents should plan for public involvement throughout the EIA process. Otherwise, it can be difficult for the EIA team to manage public opinion once work commences. The objectives of public involvement can be summarized as follows:

- Informing the stakeholders about what is proposed and providing the opportunity for input from the local community thereby creating a sense of ownership of the proposal.
- Providing an opportunity for the members of public to present their views and values, therefore allowing more sensitive consideration of mitigating measures and trade-offs.
- Providing those in charge of project planning with an opportunity to ensure that the benefits are maximized and that no major impacts have been overlooked.
- Providing an opportunity for the public to influence project design in a positive manner.
- Increasing public confidence in the reviewers and decision-makers.
- Providing transparency and accountability in decision-making.
- Reducing conflict through the early identification of contentious issues.

When Should Public Involvement Begin?

Public participation should commence at the screening stage of a proposal and then continue throughout the whole EIA process. This is represented in the diagram below produced by the World Bank to show how public involvement is incorporated into the Bank's procedures.



Screening

EIA authorities should consult with people likely to be affected by a proposal in order to understand more clearly the nature and significance of the likely impacts. This information will assist in determining if an EIA is required and defining the parameters of the scope.

Scoping

All stakeholders should be involved at the scoping stage to ensure that all significant issues are identified, public perception is assessed, and alternative ways of achieving the project objectives are considered.

Assessing and mitigating

Further involvement of the public in these phases of the EIA preparation can help avoid biases and inaccuracies in the analysis. Also, it will reveal local values, allow for a more informed analysis of impacts, and assist in the consideration of mitigating measures.

Exhibiting and reviewing

Exhibition provides further opportunities for public involvement. Response methods other than writing should be allowed to cater for uneducated members of the public. Public hearings should be held at this stage, and should be structured in informal manner to encourage affected people to "speak out."

Implementing and monitoring

Following project approval, the detailed design, construction and operating phases proceed. Increasingly, it is realised that the evolution of projects through these phases, and in combination with other changes and developments, can present environmental challenges that require adaptive management. An emphasis on environmental management and the participation of local representatives in the monitoring process can help proponents and approval agencies to respond to problems as they arise. Such interaction with local communities will also promote good relations between the proponent and the public.

Constraints to Public Participation

When designing public involvement programme the following constraints should be noted to make the programme more effective:

- Level of poverty
- Rural settings
- Illiteracy and lack of command of local language
- Local values/culture
- Different languages and dialects
- Conflicting legal and traditional systems
- Presence of various interest groups
- Confidentiality

Methods of Public Participation

A combination of the following methods can be used to engage the public in the EIA process:

1	Public hearings	• Open, without restrictions as to who may attend
2	Advisory panels	• Group of individuals chosen to represent stakeholders • Meet periodically to assess work done/results obtained • Advise on future works
3	Public information centres	• Facility provided in an accessible location • Contains information on the project • Members of the public can visit, obtain information and express concerns
4	Interviews	• Open-ended interviews with selected community representatives
5	Questionnaires	• Written, structured series of questions issued to local people to appraise concerns/views/ideas
6	Participatory appraisal techniques	• Systematic approach to discuss and assess issues based on group inquiry and analysis with multiple and varied inputs

Public Hearing

A public hearing is a formal meeting organized to discuss and give inputs to draft EIAs and design projects. During the hearings, authorities should give information on the project, after which the participating citizens should be able to give their opinion. Public hearings provide an opportunity for stakeholders to challenge a proposal, but give little opportunity for the real exchange of information and ideas.

To inform the public, the environmental authority and the developer should advertise through local mediums of communication, offering the essential information pertaining to the hearing to be scheduled and the local contacts for further information.

Before the actual date of project hearing, the authorities and developer should organise an open house in the municipal building closest to the future construction site where project sketches, maps and other information should be displayed and project hand-outs available. Open house events can be scheduled for different days, time periods, and venues to be convenient to all stakeholders. It may also be helpful to provide a questionnaire or comment sheet to assist visitors in providing feedback.

When preparing public hearing, substantial efforts should be made to overcome evident constraints to public consultation such as poverty, the dispersed nature of rural populations, illiteracy, cultural characteristics, which all might become obstacles to efficient participation.

The objectives, methods and results of consulting the public, as well as all the written comments received by the deadline during an EIA public consultation process, must be documented in the EIA. Lists of individuals, groups and organizations, which have been consulted, should be attached to the report.

5. SPECIFIC FEATURES OF EIA FOR THERMAL POWER PLANT PROJECTS

5.1. Thermal Generation Capacity Expansion in ECOWAS

Total thermal generation capacity installed in the ECOWAS Member States to date amounts to 5,923.89 MW. A significant part of the regional capacity (3,314 MW) is located in Nigeria. Figure 5.1 shows capacity distribution among the ECOWAS Member States.

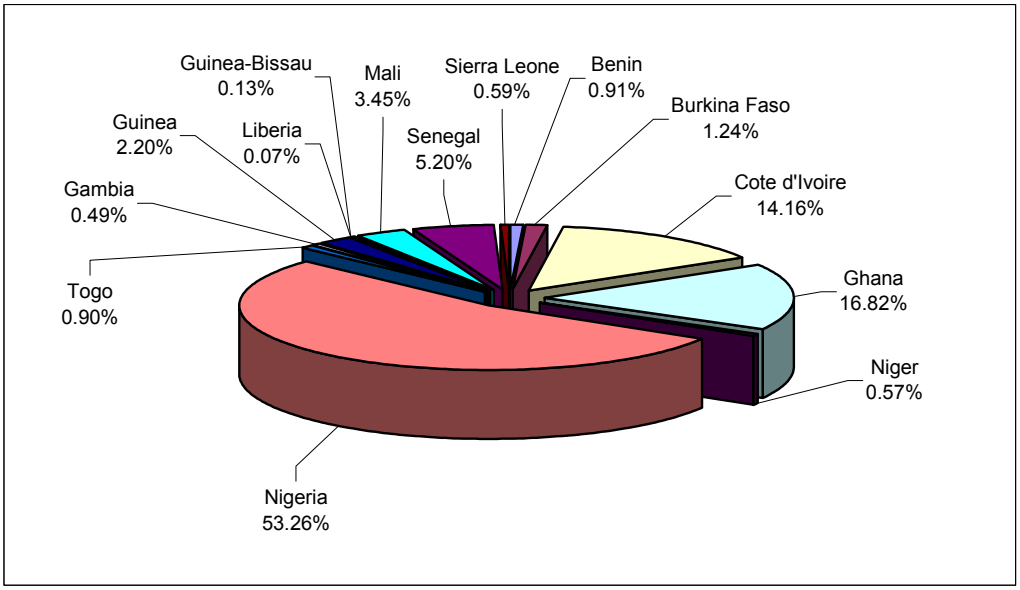


Figure 5.1: Geographic Distribution of Total Installed Capacity in the ECOWAS Region.

Extrapolation based on a forecasted 5.5% annually compounded growth rate and assuming halt of further deterioration of existing thermal generation facilities through better maintenance, yields the need for building new regional generation facilities by 2020 to facilitate additional 14,200 to 19,500 MW. As part of the response to this need, the WAPP Master Plan includes the rehabilitation of existing thermal power plants and building of additional thermal capacity.

Retrofit of existing thermal facilities concerns mostly Nigeria, where the power sector was seriously neglected for the decade prior to 1999. In Togo, the IPP Electrotogo is currently redeveloping a run-down 50 MW thermal power plant that includes a mix of gas turbines and diesels, with the prospect of making dry season power at lower total cost than an all-new plant. Additionally, some new low-speed diesel facility construction is underway in Senegal.

By year 2015, roughly 8,879 MW of new thermal capacity is expected to be built, consisting of predominantly gas-fired, combined cycle generation units. With the arrival of the WAPP-related international interconnections, new generation requirements outside of Nigeria may also be addressed by economical conversion of simple cycle plants to combined cycle plants in Ghana and Côte d'Ivoire, adding about 500 MW to the regional supply.

5.2. Environmental Consequences of Thermal Power Plant Projects

The planned thermal generation capacity expansion in the ECOWAS region will inevitably have certain environmental impacts. These impacts specifically relate to:

- Rehabilitation of the existing power plants
- Construction of new generation facilities
- Operation of thermal power plants

Rehabilitation of thermal generation units requires an environmental audit of the existing plant and an assessment of rehabilitation options with respect to the future impact on the nearby populations and ecosystems.

An environmental analysis for the rehabilitation of thermal installations is typically less comprehensive then that required for a new plant. However, the environmental audit should not be restricted to the parts of the plant that will be rehabilitated. It should cover all aspects of the equipment and operating procedures in order to identify problems and recommend measures to improve the installations' environmental performance.

Rehabilitations that involve a substantial extension of the expected operating life of the plant (10 years and more) should be subject to environmental assessment similar in depth and coverage to that of a new plant. In such cases, rehabilitated plants would normally be expected to comply with the environmental technical norms and standards for new thermal power plants: emissions of particulate matter, gaseous emissions, wastewater discharges, noise etc.

Rehabilitation, construction and operation of power plants may pose various hazards to natural environment and public health. It is important to keep in mind that initial critical assessment of options and alternative technical solutions prior to the beginning of construction could greatly reduce impacts on the surrounding environment.

5.2.1. Environmental Impacts of Thermal Power Plants Construction

Both permanent and temporary impacts can result from activities involved in the construction of a thermal plant. Construction typically lasts between 2 and 5 years. The building period is shorter for diesel engine-driven power plants used for power generation capacities of up to 150 MW. Construction activities include:

1. Clearing of vegetation
2. Obtaining raw materials, e.g.: mining, water abstraction
3. Transporting raw materials, machinery and labour to the site
4. Excavation and filling
5. Disposal of construction and domestic wastes
6. Restoration, e.g.: resurfacing and replanting of exposed areas

Construction of thermal power plants is accompanied by the following phenomena:

- Effects related to land-take and land use
- Impact on aesthetics

- Impact on soil
- Impact on ambient air quality
- Noise emission
- Impact on water quality
- Impact on social systems

Land-take and Land Use

The construction of a thermal electric generating facility can occupy acres of land, leading to the clearing of large areas for power plant components alone. Thermal power plants also need on-site fuel storage facilities as well as structures for connecting to the transmission grid, which require additional land. Moreover, thermal power plants sometimes require construction of port facilities and pipelines to make possible the supply of fuel to the plants, which will further affect the environment in the project area.

Land expropriation should be carried out in accordance with the applicable resettlement legislation. This normally requires identification and quantification of any impacts on livelihood of people around the project sites, compensation to landowners and people relying on the land for their livelihood. Generally, project proponents should co-ordinate with landowners for farm operations, including ploughing, crop dusting, and harvesting. Farmers should be compensated for crop damage and compacted soil should be restored.

Impact on Aesthetics

Severe temporary adverse impacts on the visual landscape will result during the construction process due to land clearing, scarring and establishment of temporary construction facilities. More permanent impacts can also result if borrowed areas are not restored and waste disposal is inappropriate.

Aesthetics impact analysis should include:

- Description of the physical changes associated with the proposed project, such as vegetation clearing for access roads, project site etc.
- Discussion of short-term construction impacts, and proposed short-term and long-term visual mitigation measures and the expected effectiveness of such mitigation.

Impact on Soil

Construction of the power plant requires the clearing of vegetation resulting in potential sedimentation and soil erosion. The disturbance to vegetation during the construction of a power plant should be minimized. Impacts to vegetation result in impacts to other resources, including soil erosion, which adversely impacts archaeological and historic sites, as well as quality of both water and air.

Direct impacts on vegetation are caused by surface disturbance from clearing and passage of heavy equipment. Such impacts include trampling of vegetation, degradation and loss of habitat, and introduction and spread of noxious weeds and non-native plants.

De même, le fonctionnement des différents engins du chantier est susceptible d'occasionner des fuites ou le déversement des produits dangereux (carburant, huile, produits chimiques) pouvant contaminer les sols.

Ambient Air Quality

Local air pollution (including dust and odour) will result from the operation of plant machinery, emission of exhaust fumes, dust from earthworks and construction traffic on unsealed roads during construction.

Where dust levels can be seen to be affecting the general environment, the construction contractor should take the necessary steps to reduce dust levels. This may include dust suppression by watering, suspending operations where levels are severely adverse, or protection from severe air turbulence.

Noise Emission

Noise and vibration due to construction activities (e.g. blasting, machinery and vehicles circulation) may disturb local wildlife and human populations. Noise impacts can be minimized by restricting the hours during which the offending activities are carried out and, where possible, insulating machinery and/or enclosing areas of activity. It is also necessary to inform nearby populations of the timing of activities that would produce high level of noise (use of explosive etc).

Water Quality

The construction and operation of thermal power plants can have the most profound and wide-ranging negative impacts on water quality. Distortion of the local hydrological balance and drainage patterns may in turn result in:

- Disturbance of stream channels, aquatic habitat (including spawning and nursery areas) and water supply to terrestrial wildlife and human populations
- Damage to aquatic ecosystems and restrictions on downstream water use due to pollution
- Temporary increase in sediment loads due to soil erosion
- Adverse effects on water quality from oil spillages
- Washing/runoff of fuel and construction materials into local water courses
- Stagnant water bodies in pits and quarries providing suitable habitats for disease vectors

For storage schemes, changes in groundwater level may be caused by excavation. Groundwater supplies may also be contaminated by chemicals, waste oil and fuel spills.

Social Systems

The potential social impacts associated with a thermal generation project can vary considerably depending on the capacity, size and location of the plant. Potential social impacts include changes in land and natural resource use, existing trade and commerce, employment and occupations, as well as potential shifts in social, cultural and political relations.

The social impact assessment should take into account socio-economic factors and relations within and amongst communities that are likely to be affected directly or indirectly by the operation of the plant.

The following social parameters need to be studied:

- Population /Demographic Movement
  - Change in make-up of population
  - Relocation
  - In-migration or out-migration
  - Movement of workers/residents

- Economics
  - Employment generation: direct, indirect, temporary
  - Unemployment
  - Opportunities for local sourcing of goods
  - Impact on local business
  - Land tenure
  - Equal access to opportunities
  - Competition for economic resource

5.2.2 Environmental Impacts of Thermal Power Plants Operation

Thermal power technologies involve combustion of fuel oil, gas or coal to produce electricity. Various types of thermal generation technologies are used in the ECOWAS Member States. Conventional steam-producing thermal power plants are operated in Nigeria, Senegal, Côte d'Ivoire and other countries. Combined-cycle units are used to produce electricity in Ghana Senegal and Côte d'Ivoire and smaller capacity engine-driven power plants are omnipresent in the region. Niger is the only country where coal is used for electricity generation by coal mining company SONICHAR *(Société Nigérienne du Charbon)*.

The environmental requirements for fossil-fuel plants are set with respect to the impact they produce on different components of the ambient environment in which they operate: air, water, land and social systems. Impacts on natural environment should be regulated through imposition of standards for gaseous emissions, noise, excess heat and water pollution. Social impacts should be regulated by noise emission standards and the requirement of specific mitigation measures related to new demographic and economic trends.

Impact on Air

The combustion of fossil fuels to generate electricity results in the release of air pollutants that can potentially degrade ambient air quality. Among the pollutants of primary concern are the so-called greenhouse gases - carbon dioxide, carbon monoxide, methane and ozone – which cause the Earth to heat up and create what is known as the "greenhouse effect".

The principal emissions of concern from thermal power plants are:

- Particulate matter (PM) / smoke
- Nitrogen oxides (NO_x)
- Carbon monoxide (CO) and carbon dioxide (CO_2)
- Volatile organic compounds (VOCs)
- Sulphur oxides (SO_x)
- Toxic substances, including metals

The wastes generated by thermal power plants are typical of those from the combustion processes. The exhaust gases from burning coal and oil contain particulates (including heavy metals, if they are present in significant concentrations in the fuel), sulphur and nitrogen oxides (SO_x and NO_x), and volatile organic compounds (VOCs).

For example, a 500 MW plant using coal with 2.5% sulphur (S), 16% ash, and 30,000 kilojoules per kilogram (kJ/kg) heat rate will emit each day 200 metric tons of sulphur dioxide (SO_2), 70 tons of nitrogen dioxide (NO_2), and 500 tons of fly ash if no controls are present. In addition, the plant will generate about 500 tons of solid waste and about 17 GWh of thermal discharge.

Pollution Prevention and Abatement Handbook. The World Bank, 1998.

Carbon dioxide is the most significant gas being released into atmosphere in increasingly larger amounts. Emissions of CO_2 from fuel combustion generally account for the largest share of greenhouse gases (GHG). Carbon monoxide (CO) produces smog and ground level ozone. This ozone pollutes the air both in cities and rural areas and destroys productive lands used for farming and grazing.

Air emissions and effluent discharge requirements for fixed points (such as thermal power plants) allowable by the World Bank are presented in Table 2.2, 2.3 and 2.4 (Section 2.4.4) of these Guidelines.

As mentioned above, environmental requirements can be different for new and rehabilitated thermal power plants. For example, the World Bank allows twice as much particulate matter to be emitted by the rehabilitated units in comparison with the new ones. Other distinctions also exist, as illustrated in Table 5.1 below.

Table 5.1: The World Bank Air Emissions Requirements: Parameters and Maximum Values

(All values expressed as mg/Nm³ unless otherwise stated.)

Parameter	New Power Plants	Rehabilitated Power Plants
Particulate matter (PM)	50 (100 for less than 50 MW)	100 (In rare cases, 150 mg/Nm^3 is acceptable)
SO_x	• 0.2 tpd/MW (to 500MW) • 0.1 tpd/MW (incr. over 500MW) • Not to exceed 2,000 mg/Nm^3 in flue gases • Not to exceed 500 tpd	
NO_x	For thermal power plants: • Coal: 750 (260 ng/J or 365 ppm) • Oil: 460 (130 ng/J or 225 ppm) • Gas: 750 (86 ng/J or 155 ppm) For combustion turbine units: • Gas: 125 • Diesel fuel (N°.2 oil): 165 • Fuel oil (N°. 6 and other): 300	

Short smoke stacks can compound the air pollution problem through building a wake effect and the resulting plume downwash. Typically, a stack 1.5 to 2.5 times the height of the largest structure within the sphere of influence of the stack will avoid cavity and downwash problems. Correct stack height improves emissions dispersion and helps to diminish ground-level pollutant concentration. Method of calculating the correct stack height is described in detail in the Senegalese norms of emissions into the air available in electronic format.[13]

In addition, the air pollution from operation of power plant engines will have the biggest effect on humans if power plants are located in densely populated areas, such as city centres. Zoning

[13] Annexe IV: Hauteur de Cheminée. Norme sénégalaise NS 05-062. Pollution atmosphérique - normes de rejets. Octobre 2003.

requirements must be established to restrict utility installations to industrial areas, and prevent residential and commercial development from encroaching on facilities' territory.

Particulate matter (PM) - For all plants or units, PM emissions (all sizes) should not exceed 50 milligrams per normal cubic meter (mg/Nm3). The EA should pay specific attention to particulates smaller than 10 mm in aerodynamic diameter (PM_{10}), since these are inhaled into the lungs and are associated with the most serious effects on human health. Emissions of PM_{10} and fine particulates include ash, soot, and carbon compounds (often the results of incomplete combustion), acid condensates, sulphates, and nitrates, as well as lead, cadmium, and other metals.

Sulphur dioxide - Total sulphur dioxide emissions from the power plant or unit should be less than 0.20 metric tons per day per MW of capacity for the first 500 MW, plus 0.10 tpd for each additional MW of capacity over 500 MW. In addition, the concentration of sulphur dioxide in flue gases should not exceed 2,000 mg/Nm3, with a maximum emissions level of 500 tpd.

Nitrogen oxides - The specific emissions limits for nitrogen oxides are 750 mg/Nm3, or 260 nanograms per joule (ng/J), or 365 parts per million parts (ppm) for a coal-fired power plant, and up to 1,500 mg/Nm3 for plants using coal with volatile matter less than 10%; 460 mg/Nm3 (or 130 ng/J, or 225 ppm) for an oil-fired power plant; and 320 mg/ Nm3 (or 86 ng/J, or 155 ppm) for a gas-fired power plant.

For combustion turbine units, the maximum NO_x emissions levels are 125 mg/Nm3 (dry at 15% oxygen) for gas; 165 mg/Nm3 (dry at 15% oxygen) for diesel (No. 2 oil); and 300 mg/Nm3 (dry at 15% oxygen) for fuel oil (No. 6 and others).

Pollution Prevention and Abatement Handbook. The World Bank, 1998.

Noise Abatement

High noise levels from the operation of power plant engines can be a problem both on- and off-site, with the noise affecting both the surrounding community and the workers. To combat the problem on-site, facilities need to use adequate measures to protect their workers form noise.

Adequate noise control is necessary to reduce off-site noise that affects the neighbourhood. As with air pollution, zoning requirements will help to ensure that future facilities are established in industrial areas with appropriate setback and reserved open spaces. This will help to distance human population from the sources of noise.

It is generally recommended that noise abatement measures aim to achieve the following:

1. Not to exceed the Word Bank threshold values as illustrated in Section 2 (2.4.4),Table 2.5.
2. Limit the maximum increase in background levels to 3 decibels.
3. Not to exceed national limit values, where they are stricter than the World Bank norms.

Impact on Water Resources

Thermal plants require water for cooling whereas some of them also use steam to generate electricity. This water typically comes from adjacent water bodies or groundwater sources and is discharged back into the water body at significantly higher temperatures. By altering the temperature in the "mixing zone", the used water can produce significant positive and negative effects on aquatic life.

On the positive side, the warmer temperature water may create more favourable feeding and breeding conditions for certain species living near the power plant's discharge outlet. However, when the power plant is suddenly shut down for routine maintenance or unplanned outage, the resulting wide swing to colder temperatures can be lethal to sensitive aquatic populations.

Water use is a measure of the amount of water that is withdrawn from an adjacent water body (lakes, streams, rivers, estuaries, etc.), passed through various components of a power plant, and is then ultimately discharged back into the original water body. Environmental concerns surrounding water use centre around physical and chemical alteration of the water conditions and any impacts these changes may have on the plants, fish and animals residing in the ecosystem.

Water consumption refers to water sucked up in power plant operations that is lost, typically through evaporation. The primary concerns surrounding water consumption is how best to utilize this essential resource, especially in areas, such as deserts, where water is in short supply.

http://www.powerscorecard.org/elec_env.cfm (a PACE University Initiative)

To be able to check the pollution of water, facilities should have laboratories with analytical equipment to perform influent, effluent and intermediate process tests several times a day. The wastewater facilities should be regularly monitored for BOD, COD, bacteria count, ammonia, turbidity, oils and grease, temperature, pH and dissolved oxygen[14]. This information could be used to improve the facility's environmental performance.

Fuel / Oils / Chemicals Spills and Leaks / Ash / Sludge

Typically, a thermal plant will have ancillary facilities for fuel storage and waste disposal, which have significant environmental impacts depending on their design. Experience in West Africa demonstrates that consequences of liquid and solid wastes dumping can lead to:

- Widespread soil (and probably groundwater) contamination
- Fire hazard
- Employee health hazard (oil and oil fume contact)
- Risk of oily waste polluting the downstream areas

In most diesel engine units in West Africa, about 5% of the fuel goes into oily sludge. Certain power stations in the region produce up to 2,000 m^3 of sludge per year. Therefore, an effort must be made to reclaim usable oil from the stored oily sludge. Issuing oily sludge to members of community and industrial enterprises, as it is done by NPA in Sierra Leone, can also be considered.

If scheming pits and centrifuge separators are not functional, the oily sludge is either stored or washed into the surrounding environment. However, indiscriminate dumping of waste oil must not be permitted under any circumstances. Sufficient waste disposal facilities should be

[14] The limit values allowed by the World Bank can be found in Section 2 (2.4.4). Among the ECOWAS countries Ghana, Senegal and Nigeria have national limits in this area. The description of Ghanaian, Nigerian and Senegalese norms can be found in the respective country descriptions of Section 3.

maintained at all work locations, so as to adequately service operations. Waste oil should be transported weekly to a central waste oil collection point where it can be safely collected.

Waste oil should only be stored in suitable containers at designated points located around the project site. Locations should be selected taking into consideration such factors as watercourses, drainage routes, fire risks and adequate vehicular access.

All fuel storage points should incorporate suitable protective measures to effectively prevent any leakages or spillages. Practical steps should be taken to limit any environmental damage through the availability of absorbent materials, the provision of adequate bonding and, where necessary, oil traps. Notices should be posted at each waste oil point giving instructions on the proper procedure for waste oil discharge and collection.

Solid wastes that do not leak toxic substances or other contaminants should be disposed in landfills or other disposal sites. Landfills should be lined with synthetic materials to prevent leaking and contamination of nearby water bodies. Most generating facilities produce solid by-products of combustion that can be toxic. Toxics or other contaminants should be treated prior to disposal.

6. SPECIFIC FEATURES OF EIA FOR HYDROELECTRIC PROJECTS

6.1 Hydroelectricity Generation Capacity Expansion in ECOWAS

The current hydro capacity in the ECOWAS Member States is roughly 4,297.45 MW, which amounts to 42% of the total installed generation capacity (Figure 6.1).

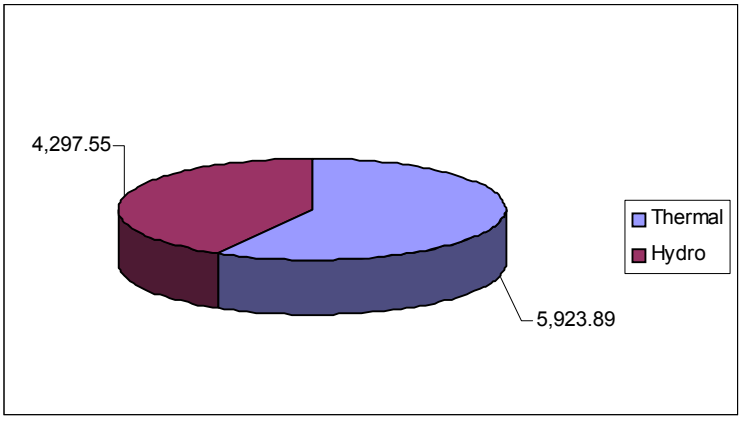


Figure 6.1: Distribution of Installed Capacity in the ECOWAS Region

WAPP will create opportunities to increase the value of several large hydroelectric plants. However, in order to maintain the necessary capacity to ensure adequate power supply in the region, new hydroelectric generation facilities must to be built.

The ECOWAS Energy Master Plan includes development of new hydroelectric schemes totalling 1,010 MW by year 2015. Priority hydroelectric schemes of the WAPP include:

- OMVG 128 MW Sambangalou (Senegal) dam and hydro plant project with a 225 kV transmission circuit to interconnect Senegal, Gambia, Guinea and Guinea-Bissau
- Kaléta hydro generation project in Guinea (105 MW)
- Fomi hydro generation project in Guinea (90MW)

ECOWAS Member States also have national plans for the development of their hydro resources. Among the hydroelectric schemes under preparation at a national level can be mentioned Adjarala in Ghana, and Bumbuna in Sierra Leone a well as the OMVS projects of second generation (Félou, Gouina).

6.2. Environmental Consequences of Hydroelectric Projects

As shown in Figure 6.2, hydropower plants harness water energy and convert it into electricity. Most hydropower plants employ the storage method (damming).

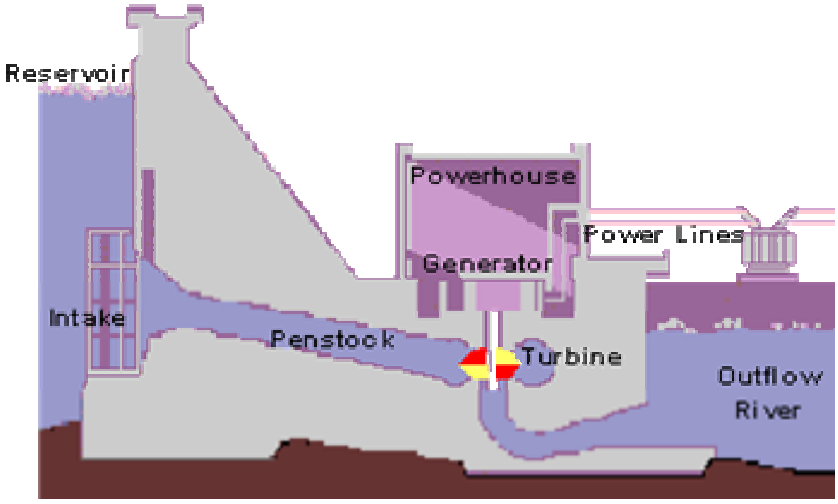


Figure 6.2: Dissected View of Hydropower Dam and Plant.

Damming water and streams has been a part of human history since recorded times, and has probably been controversial for just as long. Diverting water affects those who live downstream and modifies the habitats of plant and animal life in the affected area.

Common law has long recognized riparian rights, or rights to the use of water bordering one's land, including restrictions on diverting it away from one's land by dams built upstream. Dams and powerhouse operations have come under attack for disrupting ecosystems, spoiling the flow of great natural rivers, and displacing human populations.

There are three major types of hydropower facilities:

Storage projects impound water behind a dam, forming a reservoir. Water is released through turbine-generators to produce electricity. The water storage and release cycles can be relatively short, for instance, storing water at night for daytime power generation. Or, the cycles can be long, storing spring runoff for generation in the summer when air conditioner use increases power demand.

Run-of-river projects typically use relatively low dams where the amount of water running through the powerhouse is determined by the volume of water flowing in the river. Because these plants generally do not hold back water behind storage dams, they tend to affect upstream water levels and downstream stream flow less than storage projects. Electricity generation from these plants will vary with changes in the amount of water flowing in the river.

Pumped-storage projects use off-peak electricity to pump water from a lower reservoir to an upper reservoir. During periods of high electricity demand, the water is released back to the lower reservoir to generate electricity.

http://www.powerscorecard.org (A PACE University Initiative)

ECOWAS Member States have first-hand experience of the environmental impacts caused by hydroelectric projects from construction and operation of the current hydro generation plants. For example, the following problems have already been observed from hydroelectricity projects development in Benin[15]:

- Impact on hydrology downstream of the installation
- Difficulties related to population resettlement
- Potential loss of arable land due to flooding and erosion
- Disturbance caused to physical and chemical conditions of water resources resulting in decrease of ecosystems' productivity and sustainability of fishing resources
- Spread of diseases and decrease in water quality

Social Impacts of Hydroelectric Projects

Hydroelectric schemes are known to produce social impacts of great magnitude. For example, in Ghana, construction of Akosombo dam and hydropower plant affected 80,000 people and caused resettlement of 52 villages and Volta dam resulted in evacuation of 78,000 people from 700 villages. In Nigeria, construction of Kainji Dam displaced 42,000 people.

6.3. Specific Environmental Impacts of Hydroelectric Projects

Hydropower generation schemes construction and operation result in both temporary and permanent impacts on the environment. Such impacts will affect the following areas:

- Land-take and land use
- Vegetation
- Soil / Erosion and sedimentation
- Water resources / hydrology
- Aquatic ecosystems
- Ambient air quality
- Noise and vibration
- Health
- Social systems and cultural heritage

Land-take and Land Use

Construction will result in expropriation of significant areas of land. Land is required for dam construction, access route, powerhouse infrastructure, workforce camps, waste disposal etc. Impacts that may arise from the land-take include loss of land, encroachment onto sensitive or

[15] Benin Environmental Action Plan.

valued ecosystems, displacement of settlement and loss of agricultural land. In addition, construction activities may also result in the degradation of neighbouring land as a result of soil erosion and logging activities.

Land-take for construction activities is inevitable and, therefore, accompanying mitigation measures should include:

- Choice of the most appropriate site, minimising the total land-take through the efficient use of land and layout of facilities
- Use as much as possible of the existing roads for construction site access
- Habitat reconstruction elsewhere to compensate for habitat loss as a result of site clearing
- Relocation of people to suitable areas
- Provision of compensation in kind for lost resources
- Provision of adequate infrastructure and employment opportunities for displaced communities
- Careful choice of location for buildings, burrow pits, quarries, spoil and disposal sites

Vegetation

Expropriation of land for construction will result in loss/destruction of vegetation and forestry resources. In its turn, this will impact wildlife habitat and disturb rare and endangered species.

Some mitigation options can be recommended to reduce construction impacts on vegetation:

- Plan site location to avoid sensitive habitat
- Use as much as possible of the existing roads for construction site access
- Recover merchantable timber resources and carry out reforestation
- Reconstitute and improve affected vegetation

Soil / Erosion and Sedimentation

Earthworks include excavation of land, road construction and the felling of trees. The most significant issues associated with earthworks are typically the contamination of neighbouring watercourses and visual impact on landscape. The following measures should be taken to reduce such adverse impacts:

- Rock should be used where river training is necessary to provide sufficient road width and/or slope stability for permanent or temporary access.
- Quarries and mines used to extraction of construct material (usually located in the proximity) shall be rehabilitated.
- Excavated materials or any loose material shall not be dozed directly into the river.
- Debris or vegetation shall not be deposited in watercourses.
- All trees pushed or felled into watercourses shall be removed. If unusable for construction purposes, they can be utilized as fuel wood.
- Silt traps should be provided to eliminate the pollution of rivers or streams.

During reservoir operation, bank erosion may occur in both the reservoir behind the dam and the channel immediately downstream, affecting sedimentation. In large reservoirs, wind waves and the induced currents may reinforce erosion effect.

Flowing water carries sediment. When flow velocities are reduced in an impoundment, sediment drops out and collects on river and reservoir beds, where it can degrade in-stream habitat and cause the loss of beach at the mouth of the river. The deposited sediment may also contain chemical or industrial residues from upstream sources. The most important consequence of sedimentation is reduction in the reservoir carrying capacity.

Reservoir sedimentation can be controlled by:

- Avoiding woodcutting in the surrounding forests and encouraging tree planting and other measures for soil protection;
- Using silt traps for physical removal of sediment;
- Modifying the reservoir operation cycle to reduce sedimentation.

Water Resources / Hydrology

Construction activities (such as excavation, filling or grouting for dam and reservoirs) can alter the local hydrological balance and drainage patterns, which can:

- Disturb stream channels, aquatic habitat and water supply for terrestrial wildlife and human populations
- Facilitate intrusion of sea water upstream of estuaries
- Increase sediment loads due to soil erosion
- Create adverse effects on water quality from spillages of oil, fuel and construction materials and subsequent washing/runoff into local water courses
- Damage aquatic ecology and restrict downstream water use due to water pollution
- Create stagnant water bodies in pits and quarries, which provide suitable habitats for disease vectors.

Impoundment transforms a river environment (characterised by high velocity, turbulence, mixing of water and high re-aeration) into a lacustrine one (characterised by slower velocity, low mixing and turbulence, limited aeration, sedimentation, thermal stratification and longer residence time). This transformation brings in changes in water quality. Adverse impacts on water quality occurring in the impounded water body may also be manifested downstream as the water is discharged. Water quality impacts include increased turbidity, reduced level of dissolved oxygen concentration, eutrophication, and thermal stratification.

Measures to address negative impacts on water quality should include water quality-monitoring programmes for use in modelling studies and to enable on-going evaluation of water quality changes. This should be carried out prior to construction so that a baseline can be established against which changes during both construction and operation can be compared. Frequency and duration of monitoring should be determined according to each individual scheme.

The recommended mitigation measure consist in:

- Controlling land use and harmful discharge in the basin

- Limiting the period of water storage
- Reservoir deforestation prior to flooding

Conflict of interests in water use can also pose a problem, as the hydroelectric plant can modify patterns of available water distribution among different users (households, agriculture industry…). It can also affect water availability regional development in the future.

It is therefore important to identify potential conflicts and organise constructive discussion among different stakeholders.

Aquatic Ecosystems

Construction of dams converts the river habitat into a lake-like reservoir, thereby impacting fish and wildlife habitat. Water impoundment affects the growth rate or even survival chances of valuable aquatic species. Mercury uptake by fish, methane and CO_2 release are likely to result from reservoir operation.

Diversion of water by dams can significantly reduce the volume of water needed for the survival of aquatic organisms. Irregular release of water by dam (through withholding and releasing to generate power for peak period) may result in powerful surges that erode soil and vegetation. Water level and temperature fluctuations may result in loss of valuable aquatic life forms.

The ways in which power plant operation can impact aquatic organisms include:

- Loss of habitat as a result of flooding and displacement of fish and aquatic mammals to the downstream areas
- Entrainment, i.e. drawing in of plankton and larvae or juvenile fish through plant cooling systems
- Entrapment, i.e. accumulation of fish and other aquatic species in the intake region
- Impingement, i.e. trapping of larger organisms on barriers such as intake screen and nets
- Harmful effect of exposure to heated effluents and toxic discharges
- Accelerated growth leading to proliferation od water plants in the reservoir and downstream areas

Measures should be taken to replicate pre-project flows as much as possible, with the maintenance of water quality and adequate minimum flow. This will ensure that aquatic life is sustained and disease vectors are controlled.

Ambient Air

A temporary degradation of air quality from vehicle exhaust emissions can occur during construction. In the long term, pollutant concentrations from vehicle emissions might escalate in communities because of increased visitation. Emission of CO_2 into the atmosphere during the construction period can result in long-term changes in temperature and precipitation pattern. However, operation of hydropower plants produces little to no CO_2 emissions.

Building activities and increased vehicle traffic on unpaved roads could also temporarily increase the concentration of airborne dust and reduce visibility.

Noise and Vibration

Noise and vibration due to construction activities (e.g. blasting, machinery and traffic) may disturb local wildlife and human populations.

The noise emitted by a hydroelectric plant depends primarily on the capacity of the turbines and the gearing ratio. On average, the sound level of 70 dB is common inside a power station, whereas one can barely hear anything outside its premises.

Health

The above analysis of impacts on natural resources shows that construction and operation of hydroelectric schemes are likely to fundamentally change sanitary conditions of the project area. The following phenomena are to be expected:

- Workers' camps establishment of might lead to problems related to sanitation and propagation of such ailments as sexually transmitted diseases and HIV/AIDS,
- Expansion of water-carried diseases (malaria, bilharzias etc),
- Changes in nutrition patterns,
- Degradation of water quality and potential intake of mercury.

Social Systems and Cultural Heritage

The existence of a hydropower plant in a given area can have both negative and positive socio-economic impacts. Construction activities have the potential for disturbing heritage resources, which include architectural, archaeological and historical sites, as well as areas of unique importance because of their cultural and spiritual significance.

Potential adverse effects to heritage resources include but are not limited to:

- Destruction or degradation of the site structure and constituents that make it unique.
- Substantial adverse change in the significance of a historical or archaeological resource.
- Direct or indirect impacts to paleontological resources or unique geological features.

A number of measures can be used to mitigate such impacts:

- The project layout should avoid impacts to the identified significant historical, cultural and spiritual sites. Protective measures such as capping should be employed to preserve site constituents. In case of unintended impacts, the proponent should enter into consultation with the local ethnic groups, NGOs and relevant government agencies for possible restoration.
- If any new heritage resources are discovered during construction, work in the vicinity of the find should immediately cease and the relevant government agency notified.
- In order to better monitor all ground-disturbing activities, the proponent should employ the service of local people with first-hand knowledge of cultural resources.
- Construction workers and proponent staff should be trained in resource recognition and mitigation procedures by a qualified archaeologist and a member of the local ethnic groups.

7. SPECIFIC FEATURES OF EIA FOR TRANSMISSION LINE PROJECTS

7.1. Electric Power Transmission Capacity Expansion in ECOWAS

As illustrated in Figure 7.1, the bulk power transmission system links the electricity generating plants with local distribution. It enables utilities to deliver power over long distances, allowing use of large, economically efficient plants and taking advantage of low cost fuel or hydroelectric resources.

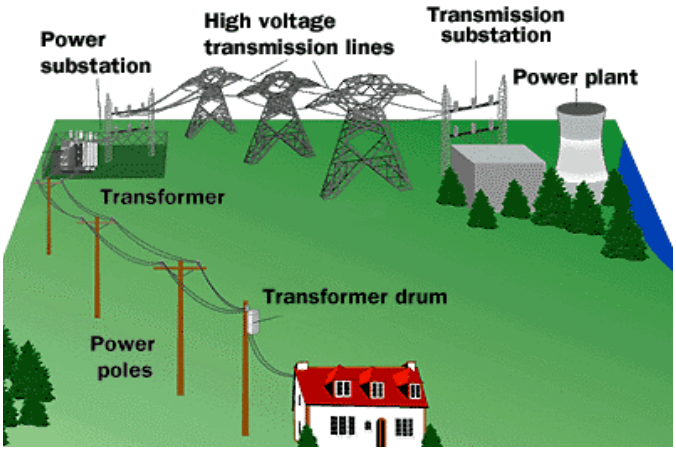


Figure 7.1: Electricity Generation, Transmission and Distribution Chain

In the ECOWAS region there is an urgent need to expand electricity infrastructure by building new transmission lines and reinforce certain existing lines. This is because the regional generation resources and capacity are not evenly distributed among the individual countries. As a result, some countries produce surplus electricity while others do not have enough generation and experience a shortage of capacity.

This situation has created a “window of opportunity” for the development of the WAPP. By building increased transmission capacity, certain countries can avoid high generation construction costs and rely on international power exchanges through the interconnected WAPP grid. This will bring considerable benefits and economic gains to the participating countries.

The WAPP Master Plan includes in its list of priority projects construction of over 4,800 kilometres of high voltage transmission ties across national borders by year 2010. The total line length by voltage level is shown in Table 7.1.

The OMVG high voltage grid, to be built to transmit electric power from the Sambangalou hydroelectric scheme, will be the longest segment of the WAPP interconnection system. The 225 kV OMVG transmission circuit will stretch over 1,720 km interconnecting The Gambia, Guinea, Guinea-Bissau and Senegal.

A number of other national and supra-national transmission lines, which are not classified as the WAPP priority projects, are also under preparation in different ECOWAS Member States.

Table 7.1: Total Length of the WAPP Priority Transmission Lines by Voltage

Transmission Voltage	330 kV	225 kV	132 kV	90 kV
Total Length	480 km	3,753 km	300 km	290 km

7.2. Environmental Consequences of Electric Power Transmission Projects

Electricity transmission lines may negatively impact the natural, social and cultural environment. They have the potential to affect natural reserves, flora and fauna and cultural heritage sites. Negative consequences for local residents and landowners may arise due to acquisition of right of way, loss of access and visual impact on the landscape. Determining the location of transmission lines requires the health and safety considerations of the local community.

The environmental impact of power transmission lines are generally linear in nature, which means that, unlike single localised development activities, linear development may affect many different habitats. The impact on natural, social and cultural resources increases with the increase in the line's length and capacity. The extent of potential impact of transmission line system depends upon:

a) The line's length, size and spacing of the pylons

b) Ancillary infrastructure (access roads, switch yards and substations)

c) The sensitivity of the environment in which the project is planned

Impacts arising from the construction and operation of transmission line projects can be avoided or managed in more cost effective manner if environmental considerations are factored in during site selection process (also called "project siting") and during the design phase.

The environmental impacts of transmission projects and associated mitigation measures identified in this section are not all-inclusive, since such projects may have location-specific environmental characteristics. Site-specific environmental issues have to be appropriately addressed in the terms of reference of the proposed EIA.

7.2.1. Environmental Impacts of Transmission Lines Construction

The construction of transmission lines is accompanied by the following phenomena:

- Right of way or wayleave
- Effects of land use and land take
- Impact on aesthetics
- Impact on terrestrial resources
- Impact on water resources
- Air pollution
- Noise emission
- Impact on local infrastructure
- Spread of diseases

Right of Way or Wayleave Size[16]

A transmission line right-of-way (ROW) is a strip of land that is used to construct, maintain, or repair a high voltage power line. The ROW allows a utility company to keep the line clear of tall trees, buildings, and other structures that could interfere with line operation. If necessary, the utility should obtain easements for access roads to get to the power line ROW.

The size of the ROW is determined by the height of the pylons (towers), as a provision for minimising damage in case of tower collapse. The size of the right of way may also depend on the land use in the area to be traversed by the power line. Table 7.2 shows ROW sizes for transmission lines of different capacity as recommended for the Southern African Power Pool members. However, the voltage values shown in the table do not exactly correspond to the ones used for power transmission in West Africa. National statutory ROW size requirements need to be taken into consideration by the utilities in the countries where such requirements exist.

One example is the Volta River Authority (Transmission Line Protection) Regulations, 1967 in Ghana[17], which define “transmission line right-of-way” as including the area extending for fifty feet (50 ft. or approximately 16 m) on either side from the ROW centre line. Until recently, this has been used for the existing transmission lines of up to 161 KV and below. However, for the new 330 kV transmission lines planned within the WAPP framework, the ROW is expected to be 40 meters. The legislation in Ghana might therefore be amended appropriately to cover the increased width of the ROW.

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[16] Generally, a right of way is land, property or interest therein, acquired for linear infrastructure such as a highway, rail bed, pipeline, electric power lines or telephone facilities. The land has been set aside as an easement or in fee, either by agreement or by condemnation. In this sense, the terms “right of way”, “wayleave” or, yet, “servitudes” are synonymous.

The Electricity Supply Regulations in Nigeria define the ROW as “a strip of land reserved for the use of power or communication lines” (Electricity Supply Regulations, 1994, made under Sections 3 and 4 of the Electricity Act. Commencement: 2nd January 1996.)

[17] See description of Ghana in Section 3.

All new right-of-way should take into consideration the need for physical alteration and impact on natural environment components, agricultural lands, cultural heritage venues, and residential and commercial areas. Information on specific local environmental requirements and characteristics should influence line routing, pylons placement and choice of structure. It is advisable to share the right-of-way with other infrastructures in order to minimize the land take.

Table 7.2: Suggested Power Transmission Line Right of Way Sizes

Transmission Line Voltage	Suggested Distance between Parallel Power Lines	Suggested Right of Way Size
765 kV	60 meters	80 meters
533 kV	40 meters	60 meters
500 kV	40 meters	60 meters
420 kV	35 meters	55 meters
400 kV	35 meters	55 meters
330 kV	35 meters	50 meters
275 kV	32 meters	47 meters
132 kV	25 meters	31 meters
88 kV	15 meters	31 meters
66 kV	15 meters	31 meters
33 kV (H-Pole)	14 meters	31 meters
33 kV	14 meters	22 meters
22 kV	12 meters	15 meters
11 kV	5 meters	10 meters

Source: SAPP (http://www.sapp.co.zw)

Land-take and Land Use

A transmission line is located at the centre of the ROW. The structures (usually poles and cross arms) keep the wires away from the ground, other objects, and each other. Structure height, type, span length (distance between structures), and ROW width are all interrelated.

The landowners wishing to have fewer transmission structures installed on their land might ask if a longer span length is possible. To increase the span length, the utility might have to increase the height of the structure. If the span length and height are significantly increased, a wider ROW is sometimes necessary.

To determine if an action may cause a significant impact, both the land area to be displaced by the ROW and the compatibility of transmission line ROW with existing land use patterns should be considered. Land use impacts associated with construction of new access roads and improvement to existing roads should also be described.

The land use impact analysis should provide:

- A description of the effects of the facility on land-based economies, including, but not limited to, agriculture, forestry, tourism, and mining.
- A description of the effects of the facility on environmentally sensitive areas.

Aesthetics

Aesthetics is how people perceive (view, hear, smell, or touch) physical environment around them. Some aesthetic areas are considered to be universally important due to the impact on cultural heritage and tourism (natural reserves, historic, recreational areas and scenic areas etc).

However, as tastes differ, impacts on aesthetics are hard to assess. Personal views on the value of aesthetics depend to a certain extent on local values. For example, the aesthetical aspect of transmission lines has significant importance in Europe, yet in Africa such concerns are less likely to bring forward strong sentiment. This has been demonstrated by such projects as the 225 kV transmission tie between Manantali and Sakal (Senegal) over 652 km[18].

Aesthetic impacts depend on the following factors:

- Physical relationship between the viewer and the power line (distance and sight line)
- The activity of the viewer (living in the area or in sight of installations)
- The background of the facility (Does it stand out or blend in? Is the background industrial or natural?)
- Individual perceptions and system of values
- The potential for mitigating impacts (planting shrubs to block the view, choice of pole material etc)

Aesthetics impact analysis should include:

- Description of the physical changes associated with the proposed project, such as transmission line support structures, access roads, conductor wires, clearing required for the right-of-way (ROW), and transformer substations.
- Evaluation of how the scenic integrity would change if the proposed project were implemented, including the potential impacts from proposed access roads and support towers.
- Description of short-term construction impacts.
- Description of proposed visual mitigation measures and the expected effectiveness of these measures.

Proponents should route lines in such a way as to avoid scenic areas by sharing corridors with busy roadways and existing lines. When constructing new lines, smaller distribution lines should be incorporated on the same poles to reduce multiple lines clustering an area. In the same way, distancing poles in order to avoid archaeological site or other sites of historical or cultural importance can be recommended.

[18] The e7 EIA Manual (French language edition).

Impact on Terrestrial Resources

During the construction phase environmental consequences for terrestrial resources would include impacts on soil, fauna and flora.

Construction vehicles traffic and creation of auxiliary structures (access roads, buildings, fences and temporary gates) will produce an impact on soil. Storage and use of fuel, lubricants, and other fluids as well as access roads could create a potential contamination hazards. This impact should be minimized or avoided by restricting refuelling activities to designated location and by requiring immediate cleanup of spills and leaks of hazardous materials.

Lubricating oils, acids for equipment cleaning, and concrete curing compounds are potentially hazardous wastes that may be associated with construction activities. Septic products to treat wastes generated during construction need to be provided for use in temporary portable water and sanitary facilities. Any soil contaminated by fuel or oil spills should be removed and disposed of by a contractor at an approved disposal site.

Construction activities may lead to such negative consequences on the fauna as destruction of habitat and displacement of certain species caused by noise and other nuisances.

The disturbance to terrestrial resources during construction can be minimized provided:

- Structures are located and designed to conform to the terrain. Levelling and benching of the structure sites is as minimal as possible to allow for structure assembly and erection. Structures are carefully located to span narrow bands of sensitive vegetative conditions.
- Existing roads are used for access to the building site whenever possible. This will help to minimize disruptions caused to the surrounding vegetation. Except where the clearing of vegetation is required, all vegetation should be protected from damage by operations.
- The clearing of vegetation from structure sites is delayed until absolutely necessary; thereby reducing the time that bare soil is exposed.
- Special attention is paid to minimizing traffic over soils susceptible to wind and water erosion.
- Reclamation is conducted shortly after the construction is completed to eliminate opportunities for weedy species invasion. It should include re-grading, mulching, fertilization, and reseeding. A native seed mix should be developed and used to reseed the disturbed areas after construction of the transmission line.
- Soil compaction due to overland traffic and structure development is minimized. Construction activities should be curtailed, if necessary, to minimize damage to saturated soils. If compaction occurs, soils should be diced as soon as possible after construction is completed.
- Any erosion/reclamation problems are corrected immediately upon discovery. The ROW should be inspected regularly both during and after construction to ensure that erosion areas are identified and re-vegetated promptly.
- Vegetative debris collected during site clearing would be scattered adjacent to the ROW to create habitat or reduce surface erosion where it would not be considered a potential fire danger.
- Removal or relocation of equipment and livestock within the ROW.
- Anticipated harvesting where possible.

Impact on Water Resources

All construction activities should be carried out using methods that would prevent accidental spillage of solid matter, debris, and other contaminating objects and waste into flowing streams, watercourses, and underground water streams. Adequate measures should be undertaken for disposal of waste oil from vehicles and equipment. No waste oil should be spilled within the right-of-way, on a construction site, or on access roads.

Project proponents should ensure that the clearing contractor erect and maintain silt fences on steep slopes adjacent to any stream, wetland, or other water reservoirs.

Mitigation measures should be implemented for construction activities involving wetlands and other sensitive habitats. The disturbance to wetlands should be minimized during construction and all disturbed areas should undergo reclamation. Specific features of such activities are:

- All open water (i.e. lakes, ponds, and artificial water reservoirs), wetland, streams, and rivers should be avoided, if possible, or spanned.
- Construction of transmission lines in wetland areas should be conducted during the dry season, if possible. This would assure that soils are dry as water levels are lower than during the wet season.
- Construction camps shall not be located in the immediate vicinity of the water reservoirs and dismantled upon completion of works. The campsites will be restored to their initial state.

Air Pollution

During construction, impacts on air quality are caused mainly by fugitive dust escaping from the site, vehicle movement on unsealed roads, and equipment exhaust fumes.

The local climate, soil conditions and existing land use pattern should be considered in assessing project impact on the surrounding air. Mitigation measures to avoid potential dust pollution and minimise construction equipment hazardous effects on local residents should be employed.

All vehicles delivering dusty construction materials to the pylon construction sites or removing soil should be covered to prevent the escape of dust. Speed limits should be applied to all vehicles accessing construction sites along unpaved roads, tracks and temporary access roads.

Noise Emission

Noise emissions will result from construction activities and work of construction mechanisms and vehicles. Measures need to be taken to ensure respect of applicable noise emission norms (noise reducing fences, noise isolation of certain mechanisms). Also, it will be necessary to to inform the neighbouring communities about the timing of works with high noise level (exploding, drilling etc). It is advisable to correctly choose the timing of such activities.

Impact on Local Infrastructure

The EIA should analyse the impacts of the project on local infrastructure in the area of the proposed project. All infrastructures situated near the line corridor (roads, telecommunication, aerials, railways, pipelines, zones of navigation etc) shall be identified and minimum distances requirements accounted for.

The transportation impact analysis should focus on potential effects of the proposed project on transportation in the project area. The analysis should review the existing transportation schemes in the area and projected requirements during construction and operation.

The following criteria must be considered in tracing of proposed roads and other areas required for the construction, maintenance, and long-term operation of the transmission projects:

- Use existing roads wherever possible
- Avoid identified biologically and culturally sensitive areas
- Minimize erosion effects
- Avoid areas with water features
- Avoid prominent topographic features
- Use the most direct route
- Coordinate tracing of access roads with the affected property owners and land managers to establish the most appropriate access to the structure sites.

Spread of Diseases

Certain unforeseen events may include spread of diseases carried by animals down a transmission corridor. Also, during construction, project workers and job seekers may move into the area and spread diseases to which the resident population has not developed immunity (in particular, sexually transmitted diseases and HIV/AIDS).

7.2.2. Environmental Impact of Transmission Lines Operation

Operation of transmission lines is likely to cause environmental problems with respect to:

- Noise
- Emission of electromagnetic fields (EMF)
- Access to ROW and maintenance works
- Electric shock and electrocution
- Animal interaction

Noise

Noise will be generated by wind passing across transmission lines and structures and "humming" of transformers. Normally, wind passing across transmission conductors would not produce any significant noise if the wind speed does not exceed 10 m/sec.

Noise abatement techniques should essentially be the same as for other types of electric power projects. The World Bank noise limits are presented in Table 2.5 (Section 2.4.4), and recommended mitigation measures are described in Section 5 (5.2.2).

Electromagnetic Fields

Electromagnetic fields are created by electrons moving in a conductor (such as a wire). They intensify as the current increases but diminish as the distance from the source grows. Objects like trees, fences and walls easily shield electric fields. The corona effect can impact the radio waves and thus affect clarity of telecommunication, radio and television signals.

Scientific studies have not found any relationship between exposure to electric fields and human disease. However, it remains standard practice to route transmission lines away from residential areas wherever possible.

The electromagnetic fields around transmission lines should be closely and regularly monitored. Advice and information should be readily available and diffused regularly to maintenance staff and the general public.

Access to Right of Way and Maintenance Works

Creation of ROW might lead to the increased access to human settlements and wild lands. Such a possibility needs to be investigated, analysed and mitigated.

The ROW maintenance will lead to bush trimming and removal of excessive vegetation. Access to the ROW should be regularly controlled and monitored during operations to ensure erosion levels remain the same or less than current conditions.

Vegetation in the ROW should be closely monitored for alien species. Shrub and low-growing trees should be planted in the ROW transiting through residential areas to minimize the visual impact.

Specific procedures will be elaborated to guide use of hazardous substances likely to pollute water and soil during maintenance activities.

Electric Shock and Electrocution

During operations, strict procedures for de-energizing and checking of electrical equipment must be observed before any maintenance work is performed. In cases where maintenance work has to be performed on energized equipment, a strict safety procedure must be followed and work must be performed under constant supervision.

Animal Interaction[19]

Apart from facilitating development of economic activities and ensuring greater public access to electricity, power transmission infrastructure can bring along certain environmental benefits. Transmission line corridors provide areas for grazing and other agricultural use as well as create the "edge effect" habitat, which can be beneficial to some wildlife species, provided vegetation is properly controlled.

However, transmission lines also have a fragmentation effect on forest and can be a hazard for certain types of animal life. Various activities related to overhead lines maintenance can have an impact on wildlife in the immediate vicinity of the servitude. These activities may cause disturbance to wildlife and livestock and habitat degradation.

Birds interact with overhead lines both in positive and negative way. Birds' collision with the lines can be a major cause of unnatural mortality. Most vulnerable are large heavy-bodied species with limited manoeuvrability - bustards, cranes, eagles, storks, vultures etc. Land use can influence the potential for bird collision with overhead lines because it can increase the attractiveness of habitats near overhead lines for foraging. The most commonly used mitigation technique is to mark the line with anti-collision devices.

Electrocution of birds is not a major concern on high voltage overhead lines due to large clearances but depending on the design used, can be a factor on certain structures.

Biological implications of wildlife interaction with overhead lines cannot be ignored. The management of these interactions must form a critical part of the overall management of the responsible electricity utility.

[19] Cited from "Guideline for the Management and Control of Electricity Utility Infrastructure with regard to Animal Interaction for the Southern African Power Pool. SAPP Environmental Sub-Committee. 2003". P. 5 - 12.

8. EIA CASE STUDIES IN WEST AFRICA

The following case studies illustrate specific EIAs for planned electrification projects in the ECOWAS region.

AFAM V Thermal Power Plant (Nigeria)

Bumbuna Hydroelectric Project (Sierra Leone)

CEB – NEPA Interconnection (Benin/Togo – Nigeria)

These case studies serve to illustrate practical implementation of the EIA techniques described in these Guidelines.

AFAM V THERMAL POWER PLANT (NIGERIA)

I. Project Background

In order to improve the power supply in the country, the Federal Government of Nigeria approved the construction of a new thermal power station. The new plant will help to improve reliability of power supply in Nigeria.

Known as AFAM V, the project involves construction of a thermal power plant and its associated facilities within the existing NEPA AFAM Power Station in Rivers State. It will have two units each with the capacity of 138,29MW, giving a total of 276,38MW. A V94.2 type of gas turbine will be used. Nigerian Gas Company will supply the natural gas.

The plant's produce will be evacuated via a 330/132kV substation and fed into the National Grid. The power plant has a life span of 25 years.

The project is located in the town of Okoloma of Oyigbo local government area of Rivers State. The objectives of the project EIA commissioned by National Electric Power Authority were to:

- Establish the existing biological and socio-economic conditions of the project area
- Characterize the environment to identify likely hazards (including social) associated with thermal power plant projects
- Make recommendations to eliminate/mitigate/control the hazards and negative effects
- Recommend control techniques to manage environmental impacts
- Recommend plans and procedures to manage the environmental consequences including compliance, monitoring and auditing
- Ensure proper consultation with the communities surrounding the proposed construction at Okoloma – Afam Ndoki in line with the requirements of the Federal Ministry of Environment of Nigeria

II. Existing Environment

In this case, all elements of the existing environment were split into two distinct scopes to reflect characteristics of natural and social environmental components. Given the nature of potential impact of thermal plants on human health, community health status was also explored as a separate issue.

Natural Environment

- Climate (temperature, rainfall, humidity, wind)
- Ambient air quality (particulates and presence of SO_2, NO, NO_2, CO)
- Noise level (measured at the gate and in nearby settlements)
- Geology (relief and stratigraphy)
- Hydrogeology (surface and underground water flows)
- Soil (pH and electrical conductivity, THC, heavy metals, chemical characteristics)

- Soil leachability and erosion potential
- Land use (arable crop production, forests exploitation for wood, building materials, medicine and hunting wildlife)
- Water quality (physico-chemical characteristics, THC, heavy metals, microbiological status)
- Fisheries (species composition and biology and fishing activities)
- Biological resources:
  - Vegetation (rain forest, patches of secondary vegetation arising after clearing)
  - Benthic fauna communities and plankton biota
  - Wildlife (insects, reptiles, mammals) with indication of endangered species

Social Environment

- Characteristics of settlement pattern in the study area
- Age distribution
- Religion (predominantly Christian with some traditional African religion)
- Educational level (one-third having no education)
- Occupation (predominantly farming, commerce and civil service, hunting, fishing and craftsmanship)
- Unemployment level (about 40%)
- Income
- Industrial/business activities
- Infrastructure development
- Transportation
- Quality of life

Community Health Status

- Housing conditions (mostly thatch roofs)
- Household energy (mainly firewood)
- Water and sanitation
- Common ailments and diseases
- Existing healthcare facilities

III. Environmental Impacts

Project-specific environmental impacts were defined in the following manner:

Climate

Climate changes are not expected to adversely impact the project activities. However, the construction phase might be slowed down as a result of heavy rain in the months of June and October. The rain affects the soil/land stability, creating waterlogged conditions and making excavation and piling activities difficult.

Air Quality

The ambient air quality parameters were measured within the existing power station and some distances (5 km range) away from the existing station with the aid of a gas and dust particulate analyzers. These measurements show that the concentrations of CO, CO_2, NO_x and SO_x are within the ranges of 0 – 1.5 ppm. These figures are considerably below FEPA limits and hence will not significantly impact human life, wild life and vegetation within the immediate environment.

Since the impact of site preparation and construction is temporary, the construction equipment (caterpillar, etc.) will increase concentration of SO_x, CO_2, NO_x and CO in the atmosphere for only a short period.

Geology/Hydrology

The potential impact of the project on the geology/hydrology would occur during the site preparation and construction. This could lead to alterations in the morphology of the area.

Excavations of topsoil and contact pressure of equipment within the working width have the potential for impacting soil structure and drainage patterns. The resulting change in porosity and permeability could significantly affect the drainage characteristics and lead to water logging. This could in turn have secondary impact on vegetation species composition and hence, a tertiary impact on landscape quality.

Noise

The potential noise level impacts of AFAM V project are expected during site preparation and construction. Noise levels resulting from these activities will be localized and are not expected to affect the surrounding environment.

The sound level of the existing plants not at full load is slightly above the Nigerian national limit. The noise level in the residential area communities is within the Nigerian national limit. With the noise barriers that will be used in AFAM V power plant construction, the noise levels are predicted to be between 60 and 70 dB (A). Consequently, impact on the noise level in the area will be minimal.

Soil

The baseline study shows that the pH of the soil samples collected at various locations (in and outside the existing power station) ranges from 6.9 to 9.8. This indicates the soils are neutral to alkaline. Also, the soils have phosphate, sulphate and nitrate contents that are favourable to agriculture. The heavy metal concentration is generally high in most of the soil samples with Fe occurring at a maximum of 209.27 ppm at drainage discharge points behind AFAM V.

During the construction phase, the main activities that would impact the soils are piling, formation of foundation base, pipeline and administrative building construction, switchyard construction, traffic of heavy equipment and land take.

During the operational phase, the impact on the soil will occur through improper housekeeping and solid waste generation. However, with proper design of AFAM V power plant and correct waste management, the environmental impact of the project will be minimal.

Vegetation/Forestry/Wildlife

The baseline study shows that the ecosystem of the project area has already been affected by the activities of the Afam power station.

Firstly, the site clearing, construction and installation activities at the early stage of the Power Station caused the modification/loss of vegetation within the power station area. This has resulted in the destruction/modification of wild life habitat and hence a reduction in wildlife population, e.g. birds, baboons, gorillas, monkeys etc.

Secondly, power operations involving gas turbines generate a lot of noise. Noise measurement at the time of the study recorded levels between 45dB(A) and 93dB(A). This level of noise could scare animals (wildlife) away from the surrounding areas. One clear indication is the reduction in hunting activities in the surrounding communities due to migration of wildlife.

Generally, there has been no significant impact from air or soil pollution in the study area. Vegetation growth (2km away from the station) was buoyant and laboratory results from leaf analysis showed that the heavy metals concentration were low to moderate.

The planned site clearing activities will have an impact on the ecosystem of the area. The creation of access roads and clearing of land areas for piling, formation of foundation base, power plant installation, water storage tank and oil tank erection, switchyard construction will lead to further deforestation of the rainforest trees and grasses and habitat destruction.

Other potential environmental impacts include the secondary succession of foreign species in cleared areas/land take areas and the destruction of terrestrial habitats that provide nesting sites for birds and squirrels.

Surface Water/Aquatic Ecology

The construction activities of the proposed AFAM V project are expected to have minimal impact on the surrounding surface water (Imo River) as the construction site is not near the river. Hence, bush clearing, excavation and construction materials may not be washed into the surface water where they can obstruct navigation.

The pH, SS and conductivity of surface water sampled within the communities show little variation and are within FEPA safe limits.

The hydrocarbon content of the water samples collected at varied distances from Ayama River and Imo River show negligible amounts of 0.001-0.002 mg/l. The heavy metal concentration in the area's surface water is slightly above FEPA limits. At the Ayama and Obunku streams, the Fe concentration recorded was 1.37 and 2.82 ppm respectively.

The operational activities might affect the physico-chemical characteristics and heavy metal concentration of the surface water thorough the discharge of oil and grease, and wastewater to the surface water. But with the construction of a good drainage system treatment plant and proper housekeeping, the impact of the project on the surface water will be minimal.

Socio-economic Environment

The project is expected to cause a significant increase in the population resulting from the influx of workers, especially during the construction phases. This would worsen the housing situation in terms of higher demand for accommodation and high density per building. The risk of introducing strange diseases (AIDS etc) would be higher. Also, prices for goods will rise and the income of the local population would increase.

There is a strong adherence to Christianity in the area. This minimizes the possibility of "forbidden" shrines and groves that might be affected by the site preparation and construction activities.

The main occupation in the area is farming; 70% of the people are farmers. This is likely to be affected by the various project activities. Land take would reduce available land used for farming. This can also result in young farmers abandoning their farming activities for a more attractive/easy employment alternative to the detriment of the farming occupation.

The Afam V project will generate employment opportunities for both semi-skilled and unskilled workers during the site preparation and construction phase of the project. The project would have a significant positive impact on average income of the area's inhabitants. This positive impact will result from an injection of money into the local economy by the incoming workers.

Community Health

The immigration of workers is expected to affect the health of the inhabitants of the project area in the following manner:

- There will be a high incidence of defecation on and around the bush area, contributing to high incidence of water-borne diseases,
- Overcrowding may worsen, which might lead to spread of air-borne and skin diseases,
- There may be an increase in sexually transmitted diseases, which would have far-reaching health implications.

IV. Mitigation Measures

Mitigation measures were established separately for construction, operation and closure phases of the AFAM V thermal power plant project.

Emergency response procedures were also developed and an Environmental Management Plan was suggested for various stages of the project. The EMP activities include:

- Provision of adequate waste management facilities and procedures
- Effective pollution control measures (monitoring)
- Environmental audit of the facilities every two years
- Regular consultations with the host communities
- Adequate training for staff to enhance environmental awareness

BUMBUNA HYDROELECTRIC PROJECT (SIERRA LEONE)

I. Project Background

In order to address the power generation shortage in Sierra Leone, the Government of Sierra Leone decided to push forward with the harnessing of the national hydropower potential. The Bumbuna Hydroelectric Power Project (HEP) was identified in a development plan for a comprehensive survey of Sierra Leone's hydroelectric potential. The Bumbuna HEP is listed as one of the WAPP priority projects.

The Bumbuna HEP is located in the north-eastern region of Sierra Leone and is about 200km northeast of its capital Freetown, while the dam is situated 4 km north of the Bumbuna Falls. A number of technical solutions were considered and the most recent feasibility study recommends the development of an installed capacity of 47 MW.

An EIA was carried out for the project. The overall objective of the environmental assessment was to identify and evaluate the positive as well as the adverse effects of the project on the physico-geographical, biotic and social environment.

The participation of local authorities was ensured through meetings with community leaders and people of the affected communities. These information meetings and public hearings were well appreciated by the communities.

II. Existing Environment

An environmental assessment that was conducted analysed the following components of the environment:

Climate	Forestry
Hydrology	Watershed management
Geology and mineral resources	Aquatic life and fisheries
Seismicity	Socio-economic and socio-cultural aspects
Water supply	Culture, history and archaeology
Ground water	Public health and water borne diseases
Water quality	Agriculture and land use
Vegetation	Tourism and recreation

It was found out that Sierra Leone lies in one of the lowest seismic zones in Africa, an appraisal of the mineral resource potential of the study area revealed the presence of only small alluvial gold deposits in the reservoir area. Only gold and quarry material are being exploited at present. Small groups of the local population carry out the gold mining in order to supplement their income from farming and handicraft.

In the downstream area considerably more mineral resources were identified, such as gold, iron ore, molybdenite, nickel, asbestos and talc deposits.

The climate in the project area reflects the general climatic pattern in Sierra Leone, which can be classified as a tropical savannah climate with a distinct tropical wet and dry season. Rainfall

measurements in and around the Bumbuna catchment area indicate an average annual precipitation of 2,635 mm at Bumbuna, 2,225 mm at Kabala in the north and 2,207 mm at Bendugu near the north eastern border with Guinea.

The filling of the Bumbuna reservoir will not increase groundwater levels on the regional level, but some changes are expected around the reservoir embankment. In the downstream area, rising groundwater levels may locally cause water logging, but the impact will be limited and no mitigation measures will be needed.

Pollution is expected to be limited because of the considerable self-purification potential of the Seli River in the project area. Nutrient loads may vary between the dry and wet season. The somewhat higher nutrient content will have mostly positive effects on the aquatic life in that there will be higher fish production in the reservoir than the former river. In addition, the enlarged water body will allow larger fish populations.

The current land use in the immediate catchment area is rainfed cultivation under traditional practices, characterised by the production of the crops also commonly grown in other parts of the country. The socio-economic impact of the Bumbuna HEP is expected to be widespread, affecting three chiefdoms. The project is designed to avoid historical and archaeological sites, however, the impact on cultural and ritual sites is far reaching and there exists a need for resettlement. Although tourism and recreation is concentrated in the coastal area, there is one site of major interest in the project area, Bumbuna Falls.

III. Environmental Impacts

A hydropower project can be expected to have a number of impacts, both positive and negative. The impacts of the project were identified as arising from the four main causes: project's location, design, construction activities and operation.

Project Location

Some 40-50 villages along the Seli River and its branch Mawaloko will be directly or indirectly affected by the project. Some villages and hamlets are expected to be flooded, thus creating a need for resettlement and compensation of about 1,000 people in and around the reservoir area. The project, however, will also bring employment opportunities and development of infrastructure including roads, rural electricity and electricity to impoverished and under developed area.

Equally, there will be a land loss of 450 hectares including fringing rainforest with wood of commercial value and representing an important wildlife habitat. Additionally, another 250 hectares of arable land will be a lost due to flooding in the catchment area.

Project Design

Impoundment to a stagnant water body is expected to cause a change in the aquatic communities. As a result, certain species like *Labeo sp.* (Cyprinids) and *Distichodus sp.,* requiring river conditions, will disappear from the reservoir area.

Further development activities for creating infrastructure for the relocated people must be designed in such a way as to avoid excessive scarring of the landscape.

Careful consideration must also be given to subsequent development of eco-tourism potential at the project design phase.

Project Construction Activities

From an ecologic point of view the impacts are unlikely to be of major significance. Aerial photographs and maps show that the transmission line route does not transect areas of pristine vegetation or nature reserves. Consequently, it is expected that the currently existing ecosystem will adapt to the new conditions and that barrier effects will be minimal.

The reservoir impoundment will cause flooding of the national road from Makeni to Kabala at parts near Fadugu and Kafogo, for which alternative routes at higher elevation have been planned.

Visual effects on natural landscape cannot be completely eliminated but will be minimized by limiting excessive visibility of the transmission line structures, for example by placing them along hill ridges and through towns.

Project Operation

About 21 km^2 of terrestrial ecosystem will be impounded and destroyed. Depending on the extent of the pre-impoundment clearing of the vegetation, the decomposition of organic matter will increase the nutrients content in the water. However, there is a high flow through the reservoir, therefore the washing out of the nutrients will take a shorter time than in larger reservoirs.

The nutrient load of the Seli River downstream of the dam will increase during the first year after impoundment of the Bumbuna reservoir. It will then steadily decrease and reach its normal seasonally fluctuating level.

The side effects of newly impounded reservoirs, e.g., eutrophication due to decaying organic matter and the subsequent explosive growth of water plants, will be minimal, if any, because of the small size of the Bumbuna reservoir and its short retention time. Furthermore, the potential for self-purification of the Seli river is high, so that even if outflowing water has a changed quality due to eutrophication, this will have little effect on the downstream reaches.

Due to the decay of submerged vegetation within the reservoir, the water quality is expected to be poor and of bad taste for the first 1-2 years of impoundment.

The main effects of the hydrological regime are the change of a running river system into a large stagnant water body and the increase in the downstream river flow during the 3-4 months of the dry season. The overall impact will be of beneficial nature.

The retention time and flood routing capacity of the reservoir is small and the downstream flow during the wet season will not change significantly. Even though the river flow during the dry season will be considerably higher than the natural dry season flow, the river bed configuration and the gradient in the downstream plains is such that this flow increase is unlikely to significantly affect the water level, the way of life of the downstream settlements. In cases where river crossings are affected, footbridges will have to be constructed.

The increased flow during the dry season can be beneficial to downstream users for irrigation purposes.

IV. Mitigation Measures

Total cost of the proposed mitigation measures rises to US$ 4.7 million, which represents about 2% of the overall construction and interconnection costs of the Bumbuna HEP estimated at US$ 200 million. A list of the major impacts and the relevant mitigation measures follows.

Impact	Proposed Mitigating Measures
Land Use	• Improvement of the catchment's area database: – Establishing land use and vegetation type maps – Monitoring trends in land use – Soil inventory and monitoring
Water Shed Management • Inundation of forest/timber in the reservoir and down stream area • Inundation of the parts of the national road • Loss of habitat	• Establishment of a detailed Watershed Management Plan – Rangeland management – Community forestry program – Reforestation • Extraction of valuable timber during construction period • Planning and construction of alternative routes • Enhanced protection of remaining lowland forest
Resettlement	• Development of a Comprehensive Resettlement Programme, "the Resettlement and Compensation Project, RECOMP". • The resettlement plan follows a "land for land" compensation strategy
Public Health	• Health education and immunization programme • Upgrading existing public health infrastructure
Legislation Development and **Capacity Building for National Institutions**	• Increased monitoring and enforcement capacity of the Forestry department • Land use legislation • Logistic support for land clearing
Tourism and Recreation	• Development of the Bumbuna falls as a natural scenic site. • Development of the Bumbuna Hydroelectric power plant as an outstanding technological novelty to be exploited as a "Technology Tourism Project".

CEB – NEPA INTERCONNECTION (BENIN/TOGO – NIGERIA)

I. Project Background

This overhead high voltage power transmission line between Benin/Togo and Nigeria is one of the most advanced priority projects of the WAPP. The project involves the extension of the existing Ikeja West substation, Ayobo – Lagos, Nigeria and the erection of a 70 km 330 kV single circuit power transmission line from the Ikeja West substation in Nigeria to Sakete in Benin Republic. 54 km of the total length lies in Nigeria, while the remaining 16 km will be constructed in Benin.

In total, five alternative technical solutions have been analysed with two of them found to be feasible:

1. An alternative based on 330 kV transmission lines between Ikeja West in Nigeria and Sakete in Benin, 330 kV transformer in Sakete and connection to the 161 kV system in Sakete, and

2. An alternative with additional 330/161 kV transformer station in Ikeja West and a 161 kV transmission line between Ikeja West and Sakete.

Both selected alternatives were studied in detail and judged technically and economically viable, i.e. the system can be operated without severe constraints, and the investments in either alternative can be paid back within less than 2 years, depending on the actual contracting arrangements and exchange of power via the new interconnection. However, though it has the highest investment costs of the two alternatives, the first solution will facilitate further development of the electrical cooperation in the region, not limited to Nigeria and Benin/Togo, but also including Ghana and other countries.

An Environmental and Social Impact Assessment (ESIA) of the project was conducted in compliance with African Development Bank's environmental policy requirements and in conformity with the Nigeria, Benin and Togo environmental protection laws.

The objectives of the ESIA study included:

- Establishing and documenting the environmental setting along the route of the 330 kV transmission line. Documenting the status quo of the people and communities in the project area together with general socio-economic considerations of the potential human impact of the project.
- Identification and analysis of sensitive environmental resources in the area using established environmental parameters.
- Identification of project environmental aspects that may interact positively or negatively with the environment.
- Identification and prediction of the positive and/or negative impacts likely to result from the project both at the construction and operational phases. Identification of mitigation and control measures to minimize the unavoidable negative impacts of the project on the entire ecosystem.
- Identification of feasible and cost effective long-term environmental monitoring plans that may reduce the unavoidable impacts to acceptable level.
- Organization of consultations with the communities bordering the area of the proposed project.

II. Existing Environment

Baseline studies were carried out to inventory existing environmental conditions to serve as a benchmark for subsequent changes detected through regular monitoring during the project implementation and operational phases. Environmental components considered while collecting the baseline data for this project included:

Biological environment: flora and fauna including the endangered species.

Socio-economic components: population trends and distribution, economic indices of human welfare i.e. educational system, transportation networks and other infrastructures like water and electricity supply, waste water and domestic waste disposal, solid-waste management, public services, medical facilities, and health impacts in the affected areas.

The particular transmission line route was selected because it had the shortest length and proved environmentally and socially acceptable during construction and operation. Accessibility for construction and operation, pollution levels and geo-technical conditions for the stability of the foundations were also taken into account. The originally planned route also underwent minor alterations at certain points to avoid passing through areas that may require expropriation and subsequent payment of heavy compensation.

III. Environmental Impacts

In the Federal Republic of Nigeria, the width of the Right of Way for the proposed transmission line is 50 metres. This would translate into the acquisition of 270 hectares of land along the 54 km ROW. The proposed line traverses a total of forty-six (46) villages/communities located in four Local Government Areas of Lagos and Ogun. It crosses over buildings, streams and rivers (Yewa, Iju, etc), farmlands, forests and other forms of vegetation. The ROW strip will eventually be cleared of all structures and vegetation.

River Yewa is the largest watercourse the line will traverse. Swamp areas on each side of the river are feeding grounds for a great number of birds, namely, herons, storks and egrets. This implies the risk of bird collisions with lines and pylons.

In the Republic of Benin, the corridor will stretch over 16 kilometres. Information obtained from aerial photos, satellite images and discussion with local authorities, indicates that the line is likely to affect four distinct geographic zones: one to the north of Sakété, one to the north-east of Sakété, the Aguidi river basin, and the territory between river Aguidi and the border with Nigeria.

The proposed corridor will traverse arable plots of land cultivated by small farms. In addition to small manioc and maze lots, there are some palm tree plantations. The banks of river Aguidi are covered with forest consisting of big trees and bamboo outgrowth.

Small human settlements are present everywhere in the area. The ROW will affect a few houses found near the proposed corridor. Slight modification of the line route can help to avoid these habitations. No significant change of the ROW is necessary.

IV. Mitigation Measures

The proposed mitigation measures include:

Clearing of ROW and Access

The ROW will be aligned taking into consideration environmental and technical factors, in a manner that will minimize, to the greatest extent possible, the need for physical alteration and impact on the sensitive natural environment, cultural resources, agricultural lands and residential and commercial areas.

As much as possible, the crossing of natural reserves will be avoided. Asphalt or impervious materials will not be used for the covering of access routes so as to facilitate vegetal re-growth at the end of the construction activities.

To reduce dust, construction materials and the roads will be regularly watered during the dry season. It is highly recommended that at project start-up and even after, information and sensitisation campaigns will be organized on safety measures for inhabitants living along the road and drivers using the road.

Vegetation along the ROW shall be kept low enough to permit safe operation. Trees felled from site shall be re-utilised for the benefit of the host communities. Areas cleared in excess of operational requirements during construction shall be restored with indigenous species and maintained for at least one year.

Land acquisition will be carried out in accordance with the prevailing laws and as per the ADB guidelines on resettlement, which require identification and quantification of impacts on land-based livelihood, and adequate compensation to landowners and people relying on the land for their livelihood. The compensation will be paid, before the start of work. The effective payment of the compensation would be one of the loan conditions.

Soil Contamination/Erosion

Prior to any excavation, the construction plan will specify the location of borrow pits and disposal areas, the recommended measures for reducing erosion and sedimentation, and the species required for re-colonization of the borrow pits and disposal areas so as to restore the sites to an acceptable level after the work. No disposal area will be authorised within the urban area, so as to protect the urban environment and thereby avoid problems relating to sanitation, congestion, nuisance, insecurity, dust, expropriation, etc.

Appropriate drainage systems shall be installed in the borrow pits and disposal areas. In some cases, it may be necessary to construct drainage structures at the top of slopes to reduce the flow rate of running water on cleared surfaces, and thereby avoid gullies. These networks will discharge into natural drains without being obstructed by mud deposits, thereby avoiding the creation of ponds. Longitudinal ditches and other running water discharge channels and drains will be of appropriate dimensions.

Measures will be implemented to reduce erosion of the embankments concerning the design of slopes and earthworks, re-vegetation of cleared areas and the construction of temporary and permanent drains to avoid risks of erosion and slipping of ditches at the top of slopes. Excavation materials and excess earth will be stored/disposed at appropriate sites approved by competent Authorities. These sites will be designed and constructed in such a way as to facilitate natural water discharge.

Physical measures should be taken to ensure proper storage of fuel, oil and bitumen in containers. Ditches and dykes shall be constructed for the discharge of oils, grease and other polluting liquids from maintenance workshops, washing and loading areas and kitchens.

Noise Control

Noise levels shall be established for each noise source. The project personnel as well as the environment that will be affected by any established noise source shall be provided or equipped with appropriate gears to protect them against any high noise effect above 85 dB(A). Feasible administrative and engineering controls, including sound-insulated equipment and control devices will be used to reduce noise level in normal working areas.

Health and Safety of Workers

The contractors and staff shall be sensitised and trained on Health and Safety measures. All facilities shall be designed to enhance safety planning. All activities shall be executed according to the relevant Nigerian, Benin and Togo legislation as well as stakeholders' interests. The contractors shall provide adequate health care and on site First Aid services for its workforce. The First Aid services shall be extended to all authorised visiting personnel.

Clean-up and Restoration

All plants, temporary buildings, equipment, rubbish, concrete forms and other materials will be removed from the vicinity of the work sites after construction. Restoration shall be implemented for the following:

- All irrigation facilities will be restored to the condition existing before arrival on site
- Any fences, gates, access roads etc, which have been damaged during construction will be restored to original state.

All cement, steel or wood installations shall be dismantled and removed. All pits and holes shall be cleaned and filled to ground level and all oil and contaminated soil shall be removed, treated appropriately and land-farmed. Finally, abandoned locations shall be replanted with indigenous plant species selected from the same or similar locality.

Environmental Monitoring Programme

The following environmental monitoring programme has been proposed for the project:

Environmental Components	Indicator Parameters	Frequency	Location	Activity By
Noise	Vehicle noise level	Monthly	*	NEPA/CEB
Electro-magnetic field	Induced electrical and magnetic fields	Yearly	*	NEPA/CEB
Biological components: Wildlife, vegetation, Land erosion	Diversity and abundance Stress	At the end of the project construction and every 3 years afterwards	*	NEPA/CEB
Socio-economic	Population, health status, safety and security, infrastructure	Twice a year	*	NEPA/CEB

* To be defined with the contractor in consultation with the relevant authorities before the start of construction/operation phases.

LIST OF SYMBOLS AND TECHNICAL TERMS

Ag	Silver	**Mg^{+2}**	Magnesium ion
As	Arsenic	**MW**	Megawatt
BOD	Biochemical oxygen demand	**N**	Nitrogen
BTU/HR	British thermal unit per hour	**Na^{+}**	Sodium ion
Ca^{+2}	Calcium ion	**Ng/J**	Nanograms per joule
Cd	Cadmium	**NH_3**	Ammonia
Cl	Chlorine	**Ni**	Nickel
CN	Cyanide	**O & G**	Oil and grease
Co	Cobalt	**P**	Phosphorous
CO	Carbon monoxide	**PAH**	Polynuclear aromatic hydrocarbon
CO_3	Carbonates	**Pb**	Lead
COD	Chemical oxygen demand	**pH**	Measure of acidity/alkalinity
Cr, total	Total Chromium	**PM**	Particulate matter
Cr^{+6}	Hexavalent chromium	**PM_{10}**	Particulate matter with aerodynamic diameter less than 10 microns
CU	Copper	**PO_3**	Phosphates
DO	Dissolved oxygen	**ppm**	Parts per million
F	Fluorine	**S**	Sulphur
Fe	Iron	**Sb**	Antimony
g/mm Btu	Grams per million Btu	**Se**	Selenium
GJ	Gigajoule	**Sn**	Tin
GW	Gigawatt	**SO_2**	Sulphur dioxide
H_2S	Hydrogen sulphide	**SO_x**	Sulphur oxides
HC	Hydrocarbons	**T**	Metric tons
HCl	Hydrogen chloride/ hydrochloric acid	**TDS**	Total dissolved solids
HCO_3	Hydro carbonates	**THC**	Total hydrocarbon content
HFO	Heavy fuel oil	**TOC**	Total organic carbons
Hg	Mercury	tpd	Metric tonnes per day
K^{+}	Potassium ion	**TPH**	Total petroleum hydrocarbon
Kg	Kilogram	**TSS**	Total suspended solids
Kg/t	Kilogram per metric tonne	**V**	Vanadium
kV	Kilovolt	**VOC**	Volatile organic compound
mg/l	Milligram per litre	**W**	Watt
mg/m^3	Micrograms per cubic metre	**Zn**	Zinc
Mg/Nm^3	Milligram per normal cubic metre		

GLOSSARY

Adverse effect: a change that is unfavourable or harmful as a consequence of the proposed development activity.

Assessment: refers to analysing and evaluating the potential impacts of proposed actions on the environment.

Baseline: existing baseline conditions are the current conditions of an area to be affected by a proposed project. Existing baselines are established prior to construction and operation of a proposed activity in order to evaluate the effects of the project on the environment.

Benthos: animals, plants or other organisms living on or within the seafloor sediments.

Biodiversity: refers to the variety of life forms on earth: the number of plants and animals and other organisms that exist on our planet and the variety within these species and the ecosystems they inhabit.

Biophysical: the part of the environment that does not originate with human activities (e.g., biological, physical and chemical processes); Pertaining to the natural environment.

Compensation measures – a monetary payment or replacement in kind for losses resulting from a development project; the re-creation of lost or damaged habitat.

Cumulative effects assessment: the assessment of the impact on the environment which results from the incremental impact of an action when added to other past, present or reasonably foreseeable projects, regardless of what agency or person undertakes such actions. Cumulative impact can result from individually minor but collectively significant actions taking place over a period of time.

Decision-maker: the person(s) entrusted with the responsibility for allocating resources or granting approval to a proposal.

Direct impact (primary impact or first order impact)**:** an impact that follows as a direct cause/effect consequence of a project activity.

Ecology: The study of interrelationships of organisms to their environment (or surroundings). Ecology considers individual organisms, populations, and communities, as well as large units of landscape such as forests, estuaries and river basins.

Ecological processes: processes that play an essential part in maintaining ecosystem integrity. Four fundamental ecological processes are the cycling of water, the cycling of nutrients, the flow of energy and biological diversity.

Ecosystem: a community and its environment (living and nonliving) considered collectively.

Environment: the total of all physical, chemical, biological and social economic factors that impinge on an individual, a community or a population.

Environmental audit: an analysis of the technical, procedural and decision-making aspects of an EIA carried out some time after a proposal has been implemented.

Environmental component: any of the various aspects of the physical or social environment, at any scale, that has been identified as being relevant to the assessment process.

Environmental evaluation: a structured investigation and evaluation of potential impacts and mitigation possibilities arising from a project proposal.

Environmental impact assessment (EIA): A formal process to predict the environmental consequences of human development activities and to plan appropriate measures to eliminate or reduce adverse effects and enhance positive effects. Also understood as the process of examining proposed projects and their reasonable alternatives for potential environmental impacts prior to making decisions on implementation

Environmental impact statement (EIS): a document or report that contains the results of an EIA study. The EIA is also referred to in some countries as Environmental Statement (ES).

Environmental management: management and control of the environment and natural resources systems in a way that ensures the sustainability of development efforts over a long-term period.

Environmental monitoring: observation of effects of development projects on environmental resources and values.

Environmental planning: all planning activities with the objective of preserving or enhancing environmental values or resources.

Evaluation: a subjective task that depends on the application of human values. It involves determining the significance of the potential impacts on the affected and interested parties.

Externalities: Effects on a project, individual or institution resulting from an action by a different project, individual or institution (e.g., market prices or pollution).

Impact/Effect (used synonymously): a reaction to a change in the environment as a result of a project action. Effects can be ecological (such as the effects on components of natural resources, the structure and/or functioning of affected ecosystems), aesthetic, historic, cultural, economic, and social, whether direct, indirect or cumulative.

Impact management plan: a structured management plan that outlines the mitigation, monitoring and management requirements arising from an environmental impact assessment.

Indirect impact (secondary impacts)**:** an environmental effect that is at least one step removed from a project activity in terms of cause-effect linkages. They are caused by actions that takes place later in time or is further removed in distance, but that are still reasonably foreseeable (e.g., development in undisturbed areas as a result of access road building.)

Initial environmental evaluation (IEE): a preliminary attempt to evaluate environmental impacts in order to determine whether a full-scale environmental impact assessment is needed. Also called "Preliminary EIA".

Interaction: a process by which a change in the condition of one component of the environment causes a change in another.

Interdisciplinary team: a group of people, from a range of disciplinary backgrounds working together to ensure the integrated use of the natural and social sciences in planning and decision-making.

Linkages: the pathways by which individual components of the environment interact with each other. Pathways include the food chain, hydrologic cycle, carbon cycle, etc.

Mitigation: an activity aimed at reducing the severity, avoiding or controlling environmental impacts of a project, through design alternatives, scheduling or other means.

Monitoring: an activity involving repeated observation, according to a predetermined schedule, or one or more elements of the environment to detect their characteristics (status and trends).

Relevant data is collected and analyzed for the purpose of evaluating the adequacy of project impact predictions and mitigation measures, improving project management methods, and developing capability for future impact assessments.

Non-governmental organization (NGO): a general term for organizations outside of government agencies such as public organizations and environmental interest groups.

Proponent: the organization, company or institution planning to initiate a project.

Public involvement: Process of informing, consulting and interacting with stakeholders affected by a proposal.

Redox (oxidisation-reduction): a chemical reaction in which one of the reactants is reduced (gains one ore more electrons) and another reactant is oxidised (loses one or more electrons).

Residual environmental impact: potential impact remaining after mitigation measures.

Resilience: the ability of a system to recover from continuous or intermittent stress within certain limits or thresholds.

Scoping: a process by which all relevant issues and concerns related to the proposed project or activity are identified and prioritised.

Screening: a preliminary stage of the assessment process for determining the level of effort, or type of EIA, required for evaluating projects.

Sensitivity: the susceptibility of an ecosystem or ecosystem component to change as a result of a given level of environmental stress.

Significance: the relative importance of an issue, concern or environmental impact, as measured by prevailing standards, regulatory requirements and societal values.

Social impact assessment: the component of EIA concerned with changes in the structure and functioning of social patterns. In particular the changes that a development would create in social relationships; community (population, structure, stability etc.); quality and way of life; language; ritual; political/economic processes; attitudes/values. This can sometimes include health impacts.

Stakeholders: those who may be potentially affected by a proposal, e.g., local people, the proponent, government agencies, NGOs, donors, and others.

Stratigraphy: (1) the arrangement of rocks in layers of strata; (2) the branch of geography dealing with the study of the nature, distribution, and relations of the stratified rocks of the earth's crust.

Sustainable use: ecologically sound use of natural resources that meets the needs of the present without compromising the ability of future generations to meet their own needs.

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