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RURAL RENEWABLE ENERGY AGENCY

SCALING UP RENEWABLE ENERGY PROGRAM (SREP)

ENVIRONMENTAL & SOCIAL MANAGEMENT FRAMEWORK

Final Report

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EXECUTIVE SUMMARY

The Environmental and Social Management Framework (ESMF) seeks to institute a consistent and effective environmental and social screening process for application in the Scaling-Up Renewable Energy Program (SREP) projects that are funded by the World Bank in Liberia. These projects are to be implemented in Lofa County, in Liberia (Figure 1). This ESMF is prepared to address potential environment and social impacts and provide mitigation measures for activities within the context of the SREP. These activities include:

- Construction of mini-grid power plants (mini-hydro and diesel hybrid plant);
- Installation of solar photovoltaic power plants;
- Installation of transmission and distribution networks;
- Construction of access roads; and
- Clearing of sites.

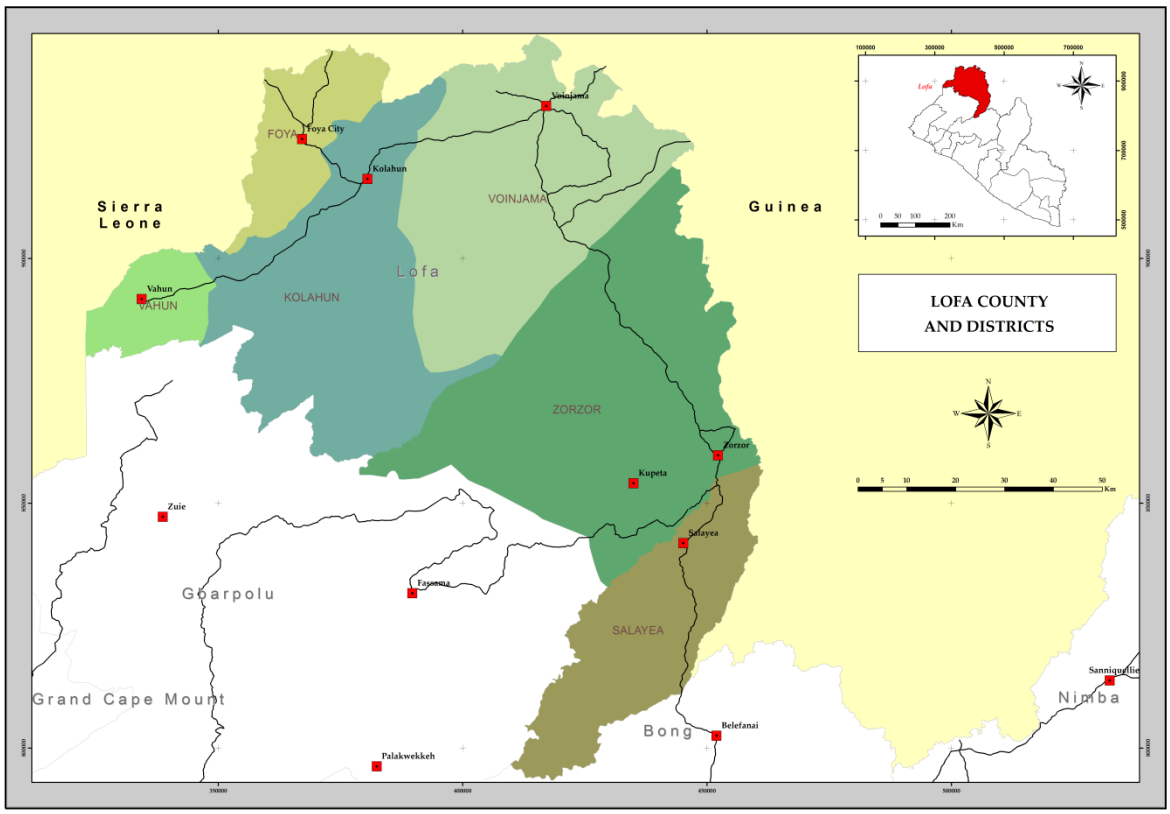


Figure 1: Map of Lofa County in Liberia.

LEGAL FRAMEWORK

A number of legislations, policies and instruments available to support environmental management and the environmental impact assessment process in Liberia are reviewed in Section 2. The Environmental Protection and Management Law and other sectoral sections in other legislations are the key instruments that cover environmental management in all the sectors of development in Liberia. The Environmental Impact Assessment Guidelines prescribe the process, procedures and practices for conducting an EIA and preparing the EIA reports. In addition to these instruments, there are sector specific policies and legislations that prescribe the conduct for managing the environment.

The EPA is the principle authority in Liberia for the management of the environment and coordinates, monitors, supervises and consult with relevant stakeholders on all activities in the protection of the environment and sustainable use of natural resources. In addition to being responsible for the provision of guidelines for the preparation of Environment Assessments and Audits, and the evaluation of environmental permits, the EPA is mandated to set environmental quality and ensure compliance for pollution control.

The main functions of the EPA are as follows:

- Co-ordinate, integrate, harmonize and monitor the implementation of environmental policy and decisions of the Policy Council by the Line Ministries,
- Propose environmental policies and strategies to the Policy Council and ensure the integration of environmental concerns in overall national planning;
- Collect, analyze and prepare basic scientific data and other information pertaining to pollution, degradation and on environmental quality, resource use and other environmental protection and conservation matters and undertake research and prepare and disseminate every two years a report on the state of the environment in Liberia;
- Encourage the use of appropriate environmentally sound technologies and renewable sources of energy and natural resources;
- Establish environmental criteria, guidelines, specifications and standards for production processes and the sustainable use of natural resources for the health and

welfare of the present generation, and in order to prevent environmental degradation for the welfare of the future generations.

Section 3 presents a thorough review of the World Banks Safeguards Policies. The policies that are considered most likely to be triggered by a sub-project are:

- OP 4.01 Environmental Assessment
- OP 4.11 Physical Cultural Resources
- OP 4.12 Involuntary Resettlement
- OP 4.37 Safety of Dams (only the part of the policy discussing the safety of small dams)

SREP PROJECT ENVIRONMENTAL & SOCIAL MANAGEMENT

A dedicated RREA team (ESMT) will be established and trained, and will be responsible for overseeing the management processes set out in this ESMF: these management processes will ensure that the SREP projects are developed with appropriate mitigation measures identified and incorporated into contracts to deliver the projects in compliance with the legal framework and in accordance with the World Bank Safeguards Policies.

The management process will include appraisal of each individual sub-project by the RREA ESMT team against a checklist set out in this ESMF, to establish the likely impacts and whether further specific studies are required to clarify impacts and detail mitigation measures. RREA ESMT will ensure that each individual sub-project to be conducted under the SREP is registered with the EPA; EPA will undertake environmental screening and environmental assessment in accordance with National processes. All projects requiring EIA will be discussed with World Bank.

RREA ESMT will ensure that appropriate mitigation measures are specified within the works contracts, and they will ensure through monitoring that these measures are implemented. The mitigation measures will include those proposed within a sub-project EIA, those identified from any further specific studies completed, and those relevant generic measures set out in the ESMF that are considered good practice.

ENVIRONMENTAL & SOCIAL IMPACTS AND MITIGATION

The potential environmental impacts that are usually associated with the implementation of small renewable energy supply alternatives, such as those proposed in the SREP context, for the purpose of electricity generation are typically not severe. These usually mild impacts will be minimized, under the supervision of the RREA ESMT, by careful site/ right of way selection, planning and staging of construction activities, adopting proper management practices during construction and operation and relying on effective environmental monitoring and training to support management decisions.

Mitigation measures are intended to reduce the effect of potentially significant impacts on the environment. Thus, they are highly dependent on the significance of the predicted impact, the nature of the impact (permanent vs. temporary), or the phase of the project (construction vs. operation). The mitigation measures to be implemented are therefore those identified within the EIAs undertaken, the further specific studies deemed necessary by RREA ESMT, or from the generic good practice measures described in this ESMF. The cost of the mitigation activities will be included as part of the construction works contract to be conducted by the contractor under the specific project.

INSTITUTIONAL ARRANGEMENT & FRAMEWORK

- In order for the Environmental and Social Management Framework (ESMF) to be effectively implemented, the presence of proper environmental management at the national level is helpful. Although environmental regulations have been evolving in the country, the main problem remains that of monitoring and enforcement, which is in turn related to the country's institutional and technical capacity for environmental management. There are many organizations involved in energy-related and activities at the national level. However, the main institution with key responsibilities for environmental and social management under the SREP is the Rural and Renewable Energy Agency (RREA), which lacks an established environmental and social management mechanism. The agency will establish an environmental and social management team (ESMT). The ESMT will be staffed by appropriately qualified people and will be trained to ensure that they are effective in overseeing the

environmental and social aspects of the sub-projects. The ESMT's main roles will be to screen for and identify the nature and magnitude of sub-projects' potential environmental and social impacts, to ensure the projects follow the national Environmental and Social frameworks, to consult with the World Bank for all projects where an EIA will be undertaken, to identify and specify the required mitigation measures and to supervise the contractors during implementation of the sub-projects, thereby ensuring that the contractors are correctly implementing the sub-project ESIAs, ESMPs, and/or RAPs. Moreover the ESMT will be in charge of conducting environmental and social monitoring, as well as internal audits and screening activities among other functions described in Section 7.

INSTITUTIONAL STRENGTHENING & CAPACITY BUILDING

A training program to ensure appropriate environmental awareness, knowledge and skills for the implementation of environmental management plans as well as environmental and process monitoring has been outlined, and will be agreed in detail with the World Bank. In an effort to strengthen institutional capacity and environmental awareness, the training sessions will be open for individuals from RREA's ESMT, and other concerned ministries and governmental authorities. Appraisal will be conducted following a training session for feedback towards improving the training program.

1 INTRODUCTION

1.1 BACKGROUND

This ESMF is a generic Environmental and Social Management Framework (ESMF) and a screening tool to identify the potential environmental and social impacts and mitigation actions to be taken for project and sub-project activities within the context of the for the Scaling Up Renewable Energy Program (SREP) project ('the Project").

Activities to be considered are: clearing of sites, construction of access roads, mini-grid power plant (mini-hydro and diesel hybrid plant), solar photovoltaic plant, and associated transmission and distribution networks at Zorzor and Voinjama.[1]

1.2 THE ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK: OBJECTIVES AND PREPARATION

This ESMF has been prepared to provide a guide to be used within existing Government Policy regulations for environment and social processes. The document will be subject to periodic review to ensure E&S management is pertinent to the specifics of the project taken forward, and to address any concerns raised by stakeholders including local and political leaders, funding and development partners, NGOs involved in natural resource management, and senior government officials and extension workers.

The objective of this ESMF is to prepare safeguards documentation for the SREP project by updating the existing sector-wide ESMF prepared in 2010 for the "Catalyzing New and Renewable Energy in Rural Liberia (CNRERL) Program" and "Liberia Electricity Sector Enhancement Project (LESEP)" and in 2013 for the Liberia Accelerated Electricity Expansion Project (LACEEP), in compliance with the Government of Liberia environmental policies and laws, and the World Bank Safeguard Policies and Guidelines on Environmental, Health and Safety (General and sector-specific guidelines).

Sub-objectives of this ESMF are as follows:

[1] Republic of Liberia, Liberia Electricity Corporation, 2015. Terms of references for updating resettlement policy framework Scaling-up Renewable Energy Program (SREP)-Liberia. Refernce No.: RREA/SREP/RPF-02/15.

- To establish clear procedures and methodologies for the environmental review, approval and implementation of the SREP's projects;
- To establish the environmental management capacity building needs for the Rural and Renewable Energy Agency (RREA);
- To specify appropriate roles and responsibilities, and outline the necessary reporting procedures, for screening, managing and monitoring environmental concerns related to projects;
- To determine the training, capacity building and technical assistance needed to successfully implement the provisions of the ESMF;
- To identify who will be responsible for preparation of the TORs for ESIAs, ESMPs and RAPs;
- To determine the institutional arrangements needed to satisfactorily screen sub-projects including identification of the safeguard instruments to be prepared, the procurement of the consultants who will prepare them, and the identification of who will supervise the work of the consultants and contractors; and
- To establish the project funding required to implement the ESMF requirements.

The implementation of ESMF will help to ensure that activities under the SREP will:

- Protect human health;
- Enhance positive environmental outcomes; and
- Prevent negative environmental impacts.

2 LEGISLATIVE AND INSTITUTIONAL FRAMEWORK

This Chapter describes the applicable international standards and relevant Liberia regulatory framework that set the context within which the Project will operate. The Environmental Protection Agency (EPA) is the environmental regulatory authority in charge of issuing environmental guidelines and reviewing the Environmental Impact Assessment process.

2.1 LIBERIAN ENVIRONMENTAL ADMINISTRATIVE FRAMEWORK

2.1.1 Government Organization

2.1.1.1 National Government

Liberia's government comprises popularly-elected executive and legislative branches, the latter composed of a bicameral National Assembly consisting of the Senate (30 seats with members elected by popular vote to serve nine-year terms) and the House of Representatives (64 seats; members elected by popular vote to serve six-year terms). The country operates a dual system of statutory law based on Anglo-American common law for the modern sector and customary law based on unwritten tribal practices for the indigenous sector.

2.1.1.2 Local Government

Liberia comprises 15 administrative counties, each headed by a Superintendent and further divided into Districts, each under a District Commissioner. Each District is sub-divided into Chiefdoms headed by a Paramount Chief, and each Chiefdom is divided into Clans headed by Clan Chiefs and sub-Clan Chiefs, with urban Clans headed by Town Chiefs. The clan areas were originally related to tribal sub-groupings and whilst this still largely applies, increasing urbanization and civil war has disrupted this pattern and Clans are now defined as administrative units.

2.1.2 Environmental Institutional Framework

2.1.2.1 National Level

2.1.2.1.1 Environmental Protection Agency

The Environmental Protection Agency (EPA) is an autonomous statutory body, established under the Act Creating the Environmental Protection Agency of the Republic of Liberia 2003, hereafter referred to as the EPA Act, to address the country's environmental problems. Its mandate was subsequently confirmed when the EPA became a fully functioning entity in 2006, with the appointment of a board of directors and establishment of a Policy Council.

The EPA was established to "coordinate, monitor, supervise and consult with relevant stakeholders on all activities in the protection of the environment and sustainable use of natural resources" and as the lead national environmental agency is charged with executive authority for all environmental activities and programs relating to environmental management in Liberia. The EPA also has a key responsibility for matters relating to the issuing of an environmental impact assessment license and for compliance monitoring relating to environmental regulations and standards.

The EPA is an autonomous agency under the President with a Policy Committee chaired by the minister for Lands Mines and Energy.

2.1.2.1.2 Ministry of Lands Mines and Energy

The Ministry of Lands, Mines and Energy (MLME) was established by a 1972 Act of Legislature. The MLME has the statutory responsibility for the development of mineral, water and energy resources in Liberia; it is in charge of land surveys in all parts of the country and coordinates, administers and regulates the use of public and private lands in Liberia, including mineral resources through granting of operation licenses, and regulates beach sand mining. It works along with the Ministry of Agriculture and the University of Liberia to conduct training and research on land rehabilitation. Energy provision is administered through the same Ministry by the National Energy Committee, while water resources are the responsibility of the National Hydrological Service. The ministry's three functional areas—lands, minerals and energy—are clustered under a deputy minister of operations. The Department of Energy has an oversight role over the energy sector, as well

as the mandate to direct and supervise—through policy making and planning—efficient development of the energy sector. The Department consists of the Bureau of Hydrocarbons and the Bureau of Energy Technology and Policy Development. The MLME is part of the board of directors of LEC and RREA.

2.1.2.1.3 Ministry of Agriculture

The Ministry of Agriculture regulates the forestry as relate to plant quarantine, agro-forestry and food crop related plantations; fishery and agriculture sectors and has specific responsibilities for soil conservation. Some water resource matters used to be managed by the National Water Resources and Sanitation Board prior to the civil war, and proposals have recently been made for its re-establishment. It plans, executes, administers, manages and supervises agriculture programs and provides extension services, trains local farmers in improved cultural practices, and supplies farm inputs to enhance food security.

2.1.2.1.4 Forestry Development Authority

The Forestry Development Authority (FDA), established in 1976, was historically the government agency with primary responsibility for environmental management in Liberia. Now an autonomous body, and mandated by the National Forestry Reform Law of 2006, the FDA has responsibility for the protection, management and conservation of government-owned forests and wildlife on a sustainable basis. It manages commercial, conservation and community uses of Liberia's forest estate. It provides long- and middle-range planning in the forestry sector as well as preparing forestry policy, law and administration. It exercises control of the commercial use of state-owned forests through the granting of concessions, supervises adherence to forest legislation and concession agreements, calculates and determines forestry fees, evaluates investment proposals, executes reforestation and forest research and training and monitors activities of timber companies. The 2006 law revised the institutional framework of the FDA and created a Department of Conservation which is made up of the Division of National Parks and the Division of Wildlife with the responsibility for development and management of protected areas and wildlife respectively.

2.1.2.1.5 Ministry of Planning and Economic Affairs

The Ministry of Planning and Economic Affairs (MPEA) responsible for intersectoral coordination for s the development of policies, plans and programs for the economic, financial, social, cultural and physical development of Liberia. In fulfilling its various duties it serves as the direct link between implementing Ministries/Agencies, NGOs, private voluntary organizations, and the international community. Coordination occurs at the national, sectoral and regional planning levels and also involves the implementation of crosscutting initiatives.

2.1.2.1.6 Liberia Electricity Corporation (LEC)

The Liberia Electricity Corporation was created in 1973 to generate, transmit, distribute, and sell electricity throughout the country at reasonable rates. In July 2006, electricity was restored to parts of Monrovia for the first time in fifteen years. To ensure its efficient operation after the war, a five-year management contract was signed between LEC, the MLME and Manitoba Hydro International in 2010. The contract focuses on improving LEC's performance and expanding the consumer base in Monrovia. LEC's board is responsible for setting electricity tariffs for the power grid.

2.1.2.1.7 Rural and Renewable Energy agency

The Rural and renewable Energy agency (RREA) is an independent agency of the government established in January 2010. It has been operating so far under an Executive Order issued by the president. Its role is to facilitate and accelerate the economic transformation of rural Liberia by promoting the commercial development and supply of modern energy products and services to rural areas through community initiatives and the private sector with an emphasis—though not exclusive reliance—on locally available renewable resources. RREA was established in response to the 2009 National Energy Policy (NEP), which also called for the establishment of a Rural Energy Fund (REFUND) that would manage all domestic and international funds for electrifying rural areas. REFUND will be managed by RREA when legally established. The government is fully committed to electrifying the country, and legally establishing RREA is a key priority for this effort. A bill to establish RREA and the REFUND has been submitted to Parliament.

2.1.2.1.8 Ministry of Public Works (MPW)

The MPW is responsible for the design, construction and maintenance of roads and highways, bridges, storm sewers, public buildings and other civil works in the country. Additionally, it has responsibility for the administration of urban and town planning, as well as provision of architectural and engineering services for all government ministries and agencies. In principle, it is responsible for the installation of the entire infrastructure required for waste management delivery services including the construction of sanitary landfill facilities.

2.1.2.1.9 Ministry of Health and Social Welfare (MHSW)

The MHSW coordinates and administers all general health services in Liberia, including providing preventive services, collecting health statistics, ensuring drug availability and monitoring events and conditions affecting public health. It also maintains statistics from birth and death registrations. Through its Division of Environmental and Occupational Health, the Ministry assesses the environmental health of the population and regulates and monitors environmental impacts resulting from pollution of air, water, food/feed and soil, as well as occupational health and chemical safety. The Division had a water quality laboratory prior to the civil war, but it no longer exists.

2.1.2.1.10 Ministry of Internal Affairs

The Ministry of Internal Affairs administers the affairs of all government functionaries in Liberia, oversees the activities of all local bodies, such as chiefdoms and clans, and supervises all county superintendents.

2.1.2.1.11 Liberia Institute for Statistics and Geo-Information Services (LISGIS)

LISGIS was established by Law by the National Transitional Legislative Assembly (NTLA) on July 22, 2004. LISGIS is headed by a Director-General, and supervised and monitored by a twenty-one (21) member Board of Directors. Both the Director-General and the Board of Directors have been initially appointed by the President but thereafter, the Director-General and the Board will subsequently be appointed by the Board to minimize the involvement of Government and secure the support of all stakeholders, particularly development partners.

The duties of LISGIS include to:

- Advise on all initiatives to collect data at all levels locality/village/town, clan, districts, county, regional and national) in the context of an integrated National Statistical and Geo-Information System;
- Conduct censuses and surveys;
- Collect, analyze and disseminate social, economic, environmental and national accounts statistics of internationally acceptable standard as and when required;
- Create, establish and manage the integrated National Statistical and Geo- Database;

Support sectoral capacity to acquire access, use and contribute to the National Statistical System and the integrated National Statistical Database.

2.1.2.2 Local Level

2.1.2.2.1 County and District Environmental Committees

To decentralize environmental management, the Environmental Protection Agency Act authorizes the establishment of County and District Environmental Committees and directs the National Environmental Policy Council to provide guidelines for their establishment. Each County Committee is composed of county and district officials, traditional leaders, private citizens, and two local representatives to the national legislature. The Committee is staffed by a County Environment Officer, hired by the EPA, but responsible to the County Committee.

The District Environment Committees are to be established by and report to the relevant County Environment Committee. They are charged with promoting environmental awareness and mobilizing the public to manage and monitor activities within the district to ensure that they do not have any significant impact on the environment. The District Committees are composed of district officials, mayors, chiefs, and private citizens and are staffed by a District Environment Officer hired by the EPA.

In addition to assisting the County and District Committees in the fulfillment of their responsibilities, the County and District Environment Officers are responsible for compiling reports to the EPA, promoting environmental awareness, and conducting public hearings on

environmental impact assessment in the County and the District.

At present, two County Environmental Committees have been established; One in Sinoe County and another in Nimba County. However, EPA has established outstation offices in eight counties. The offices are staffed by Environmental Inspectors. As the County Environment Committees are established, some of the Inspectors may be reassigned as County Environment Officers.

2.1.3 Environmental Inspectors and Courts

To provide for enforcement of environmental requirements and standards, the Environmental Protection Agency Act provides for the appointment of Environmental Inspectors and the establishment of an Environmental Court system.

2.1.3.1 Environmental Inspectors

The Act authorizes the EPA to "designate its officers and duly qualified public officers/civil servants … to be environmental inspectors within such Counties and District limits." Thus, Environmental Inspectors do not have to be EPA employees, but can also be designated officers or civil servants in other branches of the government. Environmental Inspectors are authorized to enter premises, inspect activities, take samples, and review records to ensure compliance with environmental rules and regulations. The exact nature of the inspector's enforcement authority is not defined in the Act, but the Act does state that the EPA is to "…establish the conditions, rules and regulations governing the qualifications, performance, powers and duties of the Environmental Inspectors." The EPML confirms that Environmental Inspectors can write Restoration Orders to correct an activity deemed to be noncompliant with environmental rules and regulations.

2.1.3.2 Environmental Courts

The Environmental Protection Agency Act defines a two-tiered court system to hear and rule on compliance with environmental rules and regulations.

The first tier is the Environmental Administrative Court. This court is to hear and rule on complaints relating to the environment. The complaints may be regarding the actions or decisions of the EPA or an Environmental Inspector, or may be brought by a member of the

public to stop activities they believe are damaging the environment.

The second tier is an Environmental Appeals Court, established at the Judicial Circuit level.

At present, the Environmental Court system has not been formally established. EPA's 5-year strategic plan (starting July 2011) provides for an administrative court to handle environmental issues for an intermediate period before the full the establishment of an environmental court under the judicial system.

2.2 LEGISLATIVE FRAMEWORK

Table 2-1 describes the main categories of legislation in Liberia and Table 2-2 and Table 2-3 provide a summary of relevant Liberian environmental legislation and International Environmental Conventions Signed/Ratified by the Government of Liberia.

Table 2-1: Categories of Legislations in Liberia.

Law	Laws are passed by the National Legislature of Liberia comprising of the Senate and the House of Representatives. Any citizen or group of citizens, Cabinet Ministers, Managing Directors of public corporations or agencies can propose a bill to the National Legislature for enactment. The draft bill is first passed over to the appropriate Steering Committee of the Legislature. In case of environmental bill, this committee is generally the Committee on Natural Resources and the Environment. The Committee reviews, assesses and presents the bill to the Legislative Plenary with appropriate amendments for debate, public hearing and subsequent enactment by the Legislature.
Executive Order	The Executive Branch of government headed by the President can issue Executive Order without the approval of the National Legislature. The Executive orders have the power of a law provided that they do not contravene the existing law. The power of such orders has a limited time of existence.
Regulations	The national Legislature has empowered Cabinet Ministers and Managing Directors of public corporations and agencies to issue regulations for their respective functionaries without legislative approval or supervision, provided that such regulations are not inconsistent with the statutory Laws and the Constitution of Liberia.

Table 2-2: Relevant Environmental Laws.

Title	*Year*	*Description*
Conservation of the Forests of the Republic of Liberia	1953	This Law provided the framework for the use of forest and wildlife resources and allowed for the creation of government reserves, native authority reserves, commercial forests, national parks and wildlife refuges.
Supplementary Act for the Conservation of Forests	1957	This Supplementary Law also provided the framework for the use of forest and wildlife resources and allowed for the creation of government reserves, native authority reserves, commercial forests, national parks and wildlife refuges.
The Act that created the Forestry Development Authority (FDA)	1976	The Act established and defined the responsibilities of the FDA, outlined forest offences and penalties; made provision for an Advisory Conservation Committee and specified powers of forest officers with regard to trees in reserve areas.
Public Health Act	1976	It contains provision for the protection of drinking water resources and the inspection of potential sources of pollution.
The Natural Resources Law of Liberia	1979	This Law includes chapters on forests, fish, and wildlife, soil, water, and minerals.
Wildlife and National Parks Act	1988	The Act identifies a number of protected areas; specifies policies and objectives regarding wildlife and conservation in the country.
The Environment Protection Agency (EPA) Act	2002	The Act provides the Agency with the authority of government for the protection and management of the environment in Liberia. It provides for an Environmental Administrative Court to hear from aggrieved parties. It requires that an Environmental Impact Assessment (EIA) be carried out for all activities and projects likely to have an adverse impact on the environment.
The Environment Protection and Management Law	2002	The Act enables the Environment Protection Agency to protect the environment through the implementation of the Law. It arranges the rules, regulations, and procedures for the conduct of EIA. It establishes regulations for environmental quality standards, pollution control and licensing, among others.

Title	*Year*	*Description*
The National Environmental Policy Act	2002	It defines policies, goals, objectives, and principles of sustainable development and improvement of the physical environment, quality of life of the people and ensures coordination between economic development and growth with sustainable management of natural resources.
National New Forestry Reform Law	2006	The administration of this Act provides for the Forestry Development Authority to exercise the power under the Law to assure sustainable management of the Republic's forestland, conservation of the forest resources, protection of the environment, sustainable economic development with the participation of and for the benefit of all Liberians and to contribute to poverty alleviation in the country.

Table 2-3: International Environmental Conventions Signed/Ratified by the Government of Liberia.

Convention	*Status*	*Year*	*Objectives*
African Convention on Conservation of Nature and Natural Resources	Ratified	NA	To encourage individual and joint action for the conservation
Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Ratified	1981	To prevent trade of endangered or threatened species
Convention Concerning the Protection of the World Cultural and Natural Heritage	Signed	2002	To recognize and protect cultural and natural heritage for future generations
Framework Convention on Climate Change and the Kyoto Protocol	Signed	2002	• To achieve stabilization of green house gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climatic system • To strengthen the commitment of developed country parties with a view to reduce their overall emissions
Stockholm Convention on Persistent Organic Pollutants (POP)	Signed	2002	• To strengthen National Capacity and to enhance knowledge and understanding Amongst decision makers, managers, industry and the public at large on POPs • To develop a National implementation Plan (NIP) to manage the elimination of POPs.

Convention	*Status*	*Year*	*Objectives*
Ramsar Convention on Wetlands of International Importance	Signed	2003	• To manage wetland systems so that the human uses of these areas are undertaken in such a way as to retain their natural capital for future generations. • To encourage and support countries to develop and implement national policy and legislative frameworks, education and awareness raising programs, as well as inventory, research and training projects.
Convention on Biological Diversity (CBD)	Ratified	2000	• Promote Conservation of Biological Diversity. • Sustainable use of its components. • Fair and equitable sharing arising out of the utilization of genetic resources.
Convention on the Conservation of Migratory Species of Wild Animals	Ratified	2004	Aims to conserve terrestrial, marine and avian migratory species throughout their range
The Cartagena Protocol on Biosafety	Ratified	2003	To contribute to ensuring an adequate protection in the field of living modified organisms resulting from modern biotechnology
Convention on Desertification	Signed	1998	To combat desertification and mitigates the effect of drought in countries experiencing serious droughts and/or desertification
International Tropical Timber Agreement	Ratified	2008	Requires sustainable management of timber resource base, simultaneously encouraging the timber trade and the improved management of the forests
Vienna Convention for the Protection of the Ozone Layer	Signed	1996	States agreed to cooperate in scientific research on the ozone problem, to exchange information, and to adopt "appropriate measures" to prevent activities that harm the ozone layer. The obligations are general and contain no specific limits on chemicals that deplete the ozone layer.
Montréal Protocol on Substances that Deplete the Ozone Layer	Signed	1996	A protocol to the Vienna Convention for the Protection of the Ozone Layer, it is designed to protect the ozone layer by phasing out the production of numerous substances believed to be responsible for ozone depletion
International Convention on Oil Pollution Preparedness, Response, and Cooperation (OPRC), London, 1990	Signed	1995	To strengthen the legal framework for the control of environmental pollution by oil, in general, and marine pollution by oil in particular.
International Covenant on Economic, Social and Cultural Rights	Ratified	2004	ICESCR commits to work toward the granting of economic, social, and cultural rights to individuals, including labor rights and rights to health, education, and an adequate standard of living. ICESCR is part of the International Bill of Human Rights, along with the Universal Declaration of Human Rights (UDHR) and the International Covenant on Civil and Political Rights (ICCPR)

2.2.1 Constitution of The Republic of Liberia

Article 7 of the 1986 Constitution of the Republic of Liberia sets the fundamental basis for

the constitutional, legislative, and institutional frameworks for the protection and management of the environment. It also encourages public participation in the protection and management of the environment and the natural resources in Liberia.

2.2.2 The Environment Protection Agency Act

"An Act to establish a monitoring, coordinating and supervisory authority for the sustainable management of the environment in partnership with regulated Ministries and organizations and in a close and responsive relationship with the people of Liberia; and to provide high quality information and advice on the state of the environment and for matters connected therewith".[1]

Thus, the Environment Protection Agency of Liberia (EPA) was created by the Act creating the Environment Protection Agency of the Republic of Liberia, known as the Environment Protection Agency Act. The Act was approved on November 26, 2002 and published on April 30, 2003. The establishment of the EPA marked a significant step forward in the protection and management of the environment of Liberia.

Section 5 of the Act designated the EPA as the principal Liberian authority for environmental management which shall co-ordinate, monitor, supervise, and consult with relevant stakeholders on all the activities for environmental protection and the sustainable use of natural resources. Section 6 (b) of the Act stipulates that the EPA should propose environmental policies and strategies to the Policy Council and ensure the integration of environmental concerns in the overall national planning. Moreover, the EPA is empowered to carry out, among other things, the following aspects of environmental protection and management in Liberia:

- Establish environmental criteria, guidelines, specifications, and standards for production processes and the sustainable use of natural resources for the health and welfare of the present generation, and in order to prevent environmental degradation for the welfare of the future generations;

[1] Ministry of Foreign Affairs. Monrovia, Liberia. April 30, 2003. Act Creating the Environment Protection agency of the Republic of Liberia. Section 1

- Identify projects, activities, and programs for which environmental impact assessment must be conducted under this Law
- Review and approve environmental impact statements and environmental impact assessment submitted in accordance with this Act;
- Monitor and assess projects, programs, and policies including activities being carried out by relevant ministries and bodies to ensure that the environment is not degraded by such activities and that environmental management objectives are adhered to and adequate early warning and monitoring on impending environmental emergencies is given;
- Review sectoral environmental laws and regulations and recommend for amendments and to initiate proposals for the enactment of environmental legislations in accordance with this Act or any other Act;
- Encourage the use of appropriate environmentally sound technologies and renewable sources of energy and natural resources;
- Function as the national clearinghouse for all activities relating to regional and international environment-related conventions, treaties and agreements, and as national liaison with the secretariat for all such regional and international instruments.

2.2.3 Act Adopting the Environment Protection and Management Law of the Republic of Liberia

"An Act to establish a legal framework for the sustainable development, management and protection of the environment by the Environment Protection Agency in partnership with regulated Ministries and organizations and in a close and responsive relationship with the people of Liberia; and to provide high quality information and advice on the state of the environment and for matters connected therewith".[2]

Section 15 of the EMPL states that business investors should present an environmental mitigation plan to the EPA, which should include the following sections:

[2] Ministry of Foreign affairs. Monrovia, Liberia. April 30, 2003. Act adopting the Environment Protection and Management Law of the Republic of Liberia. Section 1.

- Objectives
- Description of activities to be carried out by the project to mitigate any adverse effects on the environment
- Period within which the mitigation measures shall be implemented
- Proven efficacy of the mitigation measures of indicating their experimental nature

Section 12 of the EPML requires environmental review for projects or activities that may have significant impact on the environment. The project proponent shall submit to the EPA their plans for improving environmental performance including:

- Identification of the major environmental effects; and
- A comprehensive mitigation plan in accordance with section 15 of this Law.

Section 6 of EPML requires an Environmental Impact Assessment license or permit for the commencement of such projects, and Section 13 requires the preparation of an environmental impact study for such a project.

Section 24 of the EPML requires that the EPA should ensure that projects comply with their environmental mitigation plan through monitoring of its operations. Where evidence of non-compliance occurs, the EPA shall impose remedial measures and may bring action before the Environmental Court or through the Ministry of Justice to enforce compliance.

Section 25 of the EPML gives responsibility to the EPA carrying out periodic environmental audit of activities or projects that are likely to have adverse effects on the environment

Section 58 of the EPML requires that a license must be obtained from the EPA for any type of effluent discharge into the sewage system, also in case of operation of a sewage system. This license is provided by the EPA for a period that does not exceed 1 year.

Section 61 of the EPML prohibits pollution of all Liberian Waters. In case of water pollution, a sentence and/or a fine is/are imposed on the polluting party. The latter is also responsible for the cost of the removal of the pollutant and the restoration, restitution or compensation as determined by a law court.

Section 62 of the EPML bans pollution by solid waste of any land, coastal zone or water surface, street, road or site in or on any place to which the public has access, except in a

container or at a place which has been specially indicated, provided or set apart for such purpose. In case of such pollution, a fine or a prison term is imposed on the polluting party. The latter is also responsible for the clean-up of the solid waste pollution it caused.

Section 64 of the EPML requires the acquirement of a "Solid and Hazardous Waste Disposal License" in case of generation, storage, handling, transport or disposal of hazardous waste, or else ownership or operation of a waste disposal site. The EPA provides this license for a period of not more than one year. This license entails the party who is generating the waste to take up waste management measures such as treatment, determination or recycling and re-mediation.

Section 71 of the EPML requires the acquirement of a "Pollution Emission License" for any project or activity which is likely to pollute the environment in excess of any standards or guidelines issued under the EPML. This license is provided by the EPA for a period of not more than one year.

Section 75 of the EPML prohibits the below activities in relation with a river, lake or wetland that are declared as protected areas by the EPA. These activities include:

- Use, erect, construct, place, alter, extend, remove or demolish any structure in, on, under, or over the bed;
- Excavate, drill, tunnel or disturb the bed otherwise;
- Introduce or plant any part of a plant, plant specimen or organism whether alien or indigenous, dead or alive in a river, lake or wetland;
- Introduce any animal or micro-organism whether alien or indigenous, dead or alive in a river, lake or wetland;
- Deposit any substance in a river, lake, or wetland or in or under its bed, which is likely to have adverse environmental effects on the river, lake or wetland;
- Direct or block a river, lake or wetland from its natural and normal course; and
- Drain any river, lake or wetland.

Section 91 of the EPML, states that the EPA may impose on the party that has caused or is likely to cause harm to the environment an "Environmental Restoration Order" requiring it to remedy/prevent the harm within 21 days of the service of the order. Section 92 allows the

party to request the Agency to reconsider that order by giving reasons in writing within the same period. Section 107 states that non compliance with the restoration order convicts the responsible party to imprisonment and/or a fine.

2.2.4 National Energy Policy

In February 2007, the GOL, through the Ministry of Lands, Mines and Energy (MLME), with the support of the United States Agency for International Development (USAID) published the National Energy Policy (NEP). The principal objective of the NEP is to ensure universal access to modern energy services in an affordable, sustainable and environmentally-friendly manner in order to foster the economic, political, and social development of Liberia.

The NEP recognizes the fact that energy is essential towards GOL Poverty Reduction Strategy (PRS) and the achievement of the Millennium Development Goals (MDGs).

The NEP assumes the implementation of proposed energy sector reforms founded on three essential features: (1) demonstrating the Government's resolve for good governance and ensuring financial transparency in all sector transactions; (2) overcoming the significant obstacles to private sector investment in energy supply; and (3) creating the requisite institutional and legal framework and an independent regulatory regime. In undertaking energy sector reform, the Government will also be addressing a key component of Liberia's commitment to the World Bank and other donors for debt relief under the program for Highly Indebted Poor Countries.

2.2.4.1 Key Policy Issues

The NEP addresses the following strategic issues that are implied in the principal policy objective – access, quality, cost, and institutional framework. These issues refer to the need for the various technologies and delivery options for energy products and services to be available, acceptable, affordable, and adequate.

2.2.5 National Environmental and Occupational Health Policy

The Ministry of Health and Social Welfare has a Division of Environmental and Occupation Health; however, the Division lacks standards and policies specific to industries and/or occupational hazards. The National Environmental and Occupational Health Policy

(NEOHP) was developed in 2007 to provide a framework for identifying policy needs and actions to improve occupational health and safety. It supplements the National Health Policy, which focuses on public health and health systems. The NEOHP identified the following key Environmental and occupational health needs:

1. Environmental sanitation
2. Food Safety Services
3. Water Quality and Safety
4. Vector Control & Chemical Safety
5. Waste Management
6. Disaster Management
7. Health Promotion
8. Occupational Health Services
9. Port Health
10. Pollution control
11. Sanitary engineering

2.2.6 Public Health Law

This Law provides a framework for the management of public health and health systems in Liberia. The 1976 Law is currently being updated in order to effectively govern the decentralized health sector and accommodate the changes that have taken place since its promulgation. For example, in 2010 a new chapter was added to the Law to manage HIV / AIDS.[3]

LEC shall observe policy and regulatory requirements and implement measures to safeguard public health and safety.

2.2.7 National Health Policy and National Health Plan[4]

The document, published in 2007, is a framework for health sector reforms in Liberia. The goal of the policy is to make health care delivery services throughout the country effective

[3] Liberia Ministry of Health and Social Welfare. 2010. An Act to Amend the Public Health Law, Title 33, Liberian Code of Laws Revised (1976). Accessed from the GOL website: http://legislature.gov.lr/sites/default/files/Public%20Health.pdf
[4] Liberia Ministry of Health and Social Welfare. 2007. National Health Policy and National Health Plan. Accessed from the ILO website: http://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---ilo_aids/documents/legaldocument/wcms_126728.pdf

and efficient, thereby enhancing the quality of life of the population.

2.2.8 Liberia Land Commission Act of 2009

The objective of this act is to propose, advocate and coordinate reforms of land policy, laws and programs in Liberia. It does not have adjuratory or implementation role. The goal of the commission is "to develop comprehensive national land tenure and land use system that will provide equitable access to land and security of tenure so as to facilitate inclusive sustained growth and development, ensure peace and security and provide sustainable management of the environment"[5].

2.3 ENVIRONMENTAL IMPACT ASSESSMENT PROCESS IN LIBERIA

An EIA Process Flow Chart has been included as Appendix A. The main steps in the process are:

- Prepare Application for Environmental Impact License
- Prepare Notice of Intent (NOI)
- Submit Project Brief (allow 14 working days for EPA review and feedback)
- Conduct Scoping Process:
    1. Publish NOI in Media
    2. Prepare Terms of Reference (TOR)
    3. Conduct Meetings with EPA Environmental Committee and District Environmental Committees, as needed.
    4. Conduct Public Meetings with Potentially Affected Communities
    5. Submit Scoping Report to EPA
- Prepare Environmental Review
- Obtain EPA Approval of TOR and Environmental Review
- Prepare Environmental Impact Study and Report (included in EIA)
- Prepare Environmental Impact Statement (EIS) (included in EIA)
- Develop Comprehensive Environmental Mitigation Plan and Implementation Strategy (included in EIA)
- Agency Review of EIA (within 3 months)

[5] Liberia Land Commission Act of 2009.

- Public Consultation on EIA (within first 30 days of 3 months)
- Public Hearings (EPA to decide whether to hold these)
- Liberia Line Ministries Comment on EIA
- Review by EPA Environmental Assessment Committee
- Approval or Rejection by EPA (within 3 months of receiving EIA)

2.3.1 Public Consultation Requirements of the EIA Process

Involvement of the public in the EIA commences with the launch of the EIA process and continues throughout its course. Detailed below are the different requirements of the public involvement throughout the EIA process:

1. After the submission of an application for an environmental impact assessment permit, the project proponent should publish a "notice of intent" that states the information that may be necessary to allow the stakeholders or any interested party to identify their interest in the proposed project or activity. This information should include: the nature of the project, its related activities, its timeframe and its site of operation and the area that may be impacted.
2. Before preparing the EIA document, the project proponent should conduct public consultations with the potential affected stakeholders. This procedure is called the "scoping process" which aims to: 1) inform the stakeholders about the project's details, its potential impacts on the physical, biological and socio-economic environments, and the mitigation measures that can be taken in order to minimize these impacts, and 2) get the stakeholders' input on the various related issues. By achieving this, the scoping process is also a guiding tool for the project proponent and its consultants. It helps them in identifying the project's impacts, mitigation measures and alternatives, which will form the essential part of the EIA document. The scoping process consists of publishing the project's details in the affected district's media, holding public meetings to consult directly with the affected communities and stakeholders, and incorporating the views of these stakeholders in the scoping report which is submitted to the EPA.
3. On the completion of the EIA study report, the public is invited again to participate in the EIA review through public consultation meetings. The public's views on the

EIA are taken into consideration by the EPA when deciding about approving or rejecting the project.

4. In some cases, the EPA also decides to hold a public hearing about the project in order to fortify the public participation. These cases include but are not limited to: requests by the public for a public hearing, controversy about the project or expiry of the period stipulated for receipt of comments.

3 THE WORLD BANK SAFEGUARD POLICIES

This section discusses the safeguard policies of the World Bank and their applicability. The World Bank's environmental and social safeguard policies are fundamental to its support to sustainable poverty reduction. These policies provide guidelines in the identification, preparation and implementation of programs and projects funded by or supported by the Bank.

The safeguard policies provide the opportunity for building ownership among local populations for programs and projects that are being implemented; they have often set the platform for the participation of stakeholders in project design. The World Bank's Safeguard policies include:

1. Environmental Assessment (OP4.01, BP 4.01, GP 4.01)
2. Natural Habitats (OP 4.04, BP 4.04, GP 4.04)
3. Forests (OP 4.36, GP 4.36)
4. Pest Management (OP 4.09)
5. Physical Cultural Resources (OP 4.11)
6. Indigenous Peoples (OP 4.10)
7. Involuntary Resettlement (OP/BP 4.12)
8. Safety of Dams (OP 4.37, BP 4.37)
9. Projects on International Waters (OP 7.50, BP 7.50, GP 7.50)
10. Projects in Disputed Areas (OP 7.60, BP 7.60, GP 7.60)

Several bank policies may apply to the SREP; considering the type and nature of the several projects proposed and the requirements of the Bank's safeguard policies, the following Bank policies may be triggered:

1. OP 4.01 Environmental Assessment
2. OP 4.04 Natural Habitats
3. OP 4.11 Physical Cultural Resources
4. OP 4.12 Involuntary Resettlement
5. OP 4.37 Safety of Dams (only the part of the policy discussing the safety of small

dams)

Environmental Assessment (OP 4.01, BP 4.01, GP 4.01)

This policy requires environmental assessment (EA) of projects proposed for World Bank financing to ensure that these projects are environmentally sound and sustainable, and that decision-making is improved through appropriate environmental screening, analysis of actions and mitigation of their likely environmental impacts and monitoring.

This policy is triggered if a project is likely to have potential adverse environmental and social impacts in its area of influence. As a result, the EA process usually takes into account parameters related to natural environment (air, water, and land), human health and safety, social aspects (involuntary resettlement, indigenous people, and cultural properties) and transboundary and global environmental aspects.

The construction and rehabilitation of various types of sub stations and distribution lines are likely to have some adverse environmental and social impacts. However, the locations of these sub projects are not identified yet. Therefore, the EA requires that an Environmental and Social Management Framework is established.

As a condition for the Bank appraisal of the power sector project, the policy obligates the Bank and Government of Liberia to disclose the ESMF report as a separate and stand alone document. The disclosure must precede the appraisal of the project. The disclosure should also be both in Liberia at a location accessed by the general public and local communities, and at the Infoshop of the World Bank.

Natural Habitats (OP 4.04, BP 4.04, GP 4.04)

This policy recognizes that the conservation of natural habitats is essential to safeguard their unique biodiversity. Natural habitats comprise terrestrial, freshwater, coastal, and marine ecosystems. They include areas lightly modified by human activities, but retaining their ecological functions and most native species. The Bank supports, and expects borrowers to apply precautionary approach to ensure environmentally sustainable development.

This policy will be triggered by any project that will have negative effects on natural habitats, and therefore as part of the sub-project development, the impact to natural habitat

will be investigated.

Physical Cultural Resources OP 4.11

Cultural property includes sites having archaeological (prehistoric), palaentological historical, religious and unique natural values. The Bank will normally decline to finance a sub project that will significantly damage non-replicable cultural property, and will assist only those sub projects that are sited or designed so as to prevent such damage.

It is not anticipated that the World Bank projects will adversely affect sites having archeological, paleontological, historical, religious, or unique natural values as defined under the OP 4.11. However, a screening mechanism is proposed to ensure that any such sites are identified and avoided or impacts are mitigated, in line with the cultural resources policy. Awareness of possible chance finds will be raised among the public, the project contractors and operators, and chance-find procedures will be included in construction contracts.

Involuntary Resettlement (OP/BP 4.12)

The objective of this policy is to avoid and minimize involuntary resettlement, and ensure that the displaced populations are compensated by improving their former living standards. The involuntary resettlement is an integral part of project design and should be dealt with at the earliest stages of the project preparation. It encourages community participation in planning and implementing resettlement and in providing assistance to affected people, regardless of the legality of the title of land. This policy is triggered not only if physical relocation occurs, but also by any loss of land resulting in: relocation or loss of shelter; loss of assets or access to assets; loss of income sources or means of livelihood, whether or not the affected people must move to another location.

A Resettlement Policy Framework (RPF) is being prepared in compliance with OP 4.12. The RPF outlines the principles and procedures to be applied in the event that any World Bank funded projects/subprojects involve land acquisition and thus require the mitigation of potential adverse social impacts. The OP 4.12 is not usually triggered because people are being affected by physical displacement; it is triggered because the program activity causes

land acquisition, whereby a physical piece of land is needed and people may be affected because they are cultivating on that land, they may have buildings on the land, they may be using the land for water and grazing of animals or they may otherwise access the land economically, spiritually or any other way which may not be possible during and after the sub project is implemented. Therefore, people are in most cases compensated for their loss (of land, property or access) whether in kind or in cash or both. Where there is land acquisition, impact on assets, and/or loss of livelihood, the RPF guidelines must be followed and a RAP completed prior to sub-project implementation.

In order to ensure that the displacement or restriction of access does not occur before necessary measures for resettlement and compensation are in place, the policy also requires that the resettlement plan is implemented before the start of the construction. The taking of land and related assets may take place only after compensation has been paid, and where applicable, resettlement site, new homes, related infrastructure and moving allowances have been provided to displaced persons. All displaced persons should benefit from the resettlement policy regardless of the total number affected, the severity of the impact and whether or not they have legal title to the land Special attention should be given to the needs of the vulnerable groups among those displaced.

OP 4.12 also requires the RPF to be disclosed both in Liberia and at the infoshop of the Bank before appraisal. Where there are differences between the Laws of Liberia and the Bank OP4.12, the latter must take precedence if the Bank is to fund this project.

Safety of Dams (OP 4.37, BP 4.37)

Activities in some types of electrification packages to receive financing under the World Bank power sector intervention, such as hydropower type sub projects, may involve the use/rehabilitation of existing dams (large and small), or the construction of new dams. Whereas other types of sub projects may depend only on the use of existing dams. In these particular cases, the dams will probably be used for one or a combination of these reasons;

i. as a reservoir.

ii. to manage water flow and levels in rivers/lakes.
iii. provision of head of water.

For sub projects that involve the construction of new dams, the World Bank requires that the dam be designed and its construction supervised by experienced and competent professionals. It also requires that the sub project sponsor adopt and implement certain dam safety measures for the design, bid, tendering, construction, operation, and maintenance of the dam and associated works. The Bank distinguishes between small and large dams.

Small dams are normally less than 15m in height. This category includes, for example, low embankment tanks. Large dams at 15m or more in height. Dams that are between 10 and 15 m in height are treated as large dams if they present special design complexities -for example, an unusually large flood-handling requirement, location in a zone of high seismicity, foundations that are complex and difficult to prepare, or retention of toxic materials. Dams under 10 meters are treated as large dams if they are expected to become large dams during the operation of the facility.

In the context of the SREP, only small dams may be constructed for the mini-hydro power plants. For small dams, generic dam safety measures designed by qualified engineers are usually adequate. The environmental assessment (EA) for the project should determine that there is no risk or negligible risk of significant adverse impacts due to potential failure of the structure to local communities and assets, including assets to be financed as part of the proposed project.

Table 3-1: Summary of Bank Safeguard Policies Triggered By Projects Activities and Their Requirement.

Triggered Bank Safeguard Policy	*Triggered Policy Requirement*	*Responsible Party*	*Timeframe Implementation of Action*
OP 4.01: Environmental Assessment	• Preparation of ESMF • Preparation of ESIAs for sub projects	• RREA to prepare ESMF • RREA ESMT to prepare ESIA	• ESMF to be approved by Bank & disclosed in Liberia & Bank Infoshop prior to program appraisal date. • Sub project ESIA's to be approved by Bank & EPA and disclosed in Liberia before license is granted.
OP 4.04 Natural Habitats	Conservation of natural habitat	RREA	Before appraisal identify if Natural Habitat will be affected and as necessary develop mitigation Before contract award
OP 4.11: Physical Cultural Resources	Cultural property	RREA	Before appraisal identify if Physical Cultural Resources are present in sub-projet areas, for example through a rapid archaeological survey and interview with the local population.
OP 4.12: Involuntary Resettlement	• RPF preparation • Sub project RAPs preparation	• RREA to prepare RPF • RAPs by RREA	• RPF to be approved by Bank &disclosed in Liberia & Bank Infoshop prior to program appraisal date. • Sub project RAPs to be submitted to the Bank, approved by the respective District officials & disclosed in Liberia before lincense is granted by the Regulator.
OP 4.37: Safety of Dams	• Generic dam safety measures designed by qualified engineers are usually adequate for small dams • The environmental assessment (EA) for the project should determine that there is no risk or negligible risk of significant adverse impacts due to potential	RREA	During design and construction

Triggered Bank Safeguard Policy	*Triggered Policy Requirement*	*Responsible Party*	*Timeframe Implementation of Action*
	failure of the structure to local communities and assets, including assets to be financed as part of the proposed project.		

4 PROJECT DESCRIPTION

This project builds on the Liberia Investment Plan for Renewable Energy (IPRE) prepared by the GoL and approved in October 2013 as a requirement to access Scaling-up Renewable Energy Program (SREP) funds. IPRE was developed by the government under the leadership of the Ministry of Lands, Mines and Energy, with the technical support of the Rural Renewable Energy Agency (RREA). The proposed Access Renewable Energy in Liberia (SREP-Liberia) will finance partially the first projects identified, focusing mainly on the electrification of the main populated centers of Lofa County through renewable energy sources and the operation and maintenance model of decentralized power systems in the country.

This support will focus on two main areas of action. The first area will be investing in renewable energy generation systems in economic centers of the rural areas to promote access to electricity and its productive uses through a domestic source of energy. The high production cost and low reliability of the existing electricity generation system remain key obstacles to the country's stability and sustainable economic growth. This selection was done based on a pre-feasibility work carried out by RREA in order to identify the most suitable site for expanding access to electrification, following the criteria agreed with the GoL. A pre-feasibility study of several sites has been conducted by the World Bank, financed by SE4ALL-TA funds[1], and the Government in Liberia with own funds. The results showed that in Lofa County only one of the proposed sites has potential to be developed (Zorzor). The other site close to the capital of the county, Voinjama, presents very high investment costs which make the project not feasible and the PV technology option becomes the priority. Therefore, the project will support the government's objectives to increase access to electricity at affordable cost by implementing a: (i) microgrid system (Hydro – diesel) in Zorzor (ii) microgrid system (PV – battery) in Voinjama; and (iii) Solar lantern distribution nationwide.

[1] The study included the study of 4 sites in two areas with different implementation approaches. The first approach consisted in the development of a 10-15 MW HPP in Bomi County and the construction of a 50 km transmission line needed to connect the plant to the national power system. The second approach consisted in a the combination of two isolated mini-grid systems in Lofa County with mini HPPs of 1 to 3 MW to provide electricity services to Voinjama, the capital of the county. Hydro potential is highly seasonal and required to combine with diesel based generation during the dry season. The preliminary results presented very high investment costs making the project not feasible.

The ownership model and the regulation arrangements will be defined during project preparation and appraisal. An affordable tariff structure based on consumers' ability and willingness to pay will be pursued. Rural consumers will benefit from structured tariffs. Revenues and results-based financing must recover all recurrent costs, including operation and maintenance, fuel, contributions to a sinking fund for major repairs, and a reasonable return on equity.

To ensure the sustainability of the electricity service, an operation and maintenance model should be developed. The current legislation establishes that LEC is the owner of all the electrical systems in the country; therefore, the power plants to be built under this project will become LEC's assets. However, the current situation of LEC (under management contract to provide electricity service only in Greater Monrovia) doesn't permit to expect that, in the mid-term, LEC will be capable of operate power plants in isolated areas. For this reason, a private operator could be considered because the power plants will be too large for a community-based management approach. The project will develop the regulatory framework to ensure the operation and maintenance of the rural electrification systems and to set an adequate tariff system. This regulation will set the path for the private sector to participate and to finance rural electrification.

The main project components are the following:

- Component 1. Rural access to electricity through renewable energy hybrid mini-grids in Lofa county (estimated cost $27 million).
- Component 2: Development of specific regulations for off-grid electrification (estimated cost $2 million).
- Component 3 Project implementation support and capacity building (estimated cost $1 million).

4.1 COMPONENT 1. RURAL ACCESS TO ELECTRICITY THROUGH RENEWABLE ENERGY HYBRID MINI-GRIDS IN LOFA COUNTY)

This component will finance the feasibility studies of the SHP sites as well as the solar PV systems, from the pre-feasibility stage to the preparation of bidding documents. It will also finance the energy demand analysis, the optimization of the system according to the available supply and projected demand and the business model definition, including tariff system to ensure a sustainable operation and maintenance of the systems. The implementation of the power plants, the distribution lines, substations and household connections will be part of this component. Moreover, all related safeguards activities will be included. RREA will be the implementing agency of this component with the strategic guidance from MLME.

4.1.1 Subcomponent 1A: Hybrid mini-grids

This subcomponent aims at installing renewable energy generation isolated systems in rural areas where the national grid will not be reached in the mid-term and they are either relying on informal, unreliable and expensive electricity supply from diesel generators or are lacking completely of access to electricity. The identified rural area is in the North of Lofa County, a rural economic and agricultural hub in the border with Guinea and Sierra Leone. The capital of this county is Voinjama a highly populated center in the area. This area is located more than 200 km from the national grid and there are no prospects in the mid-term to reach this area with the national grid, nowadays only serving Greater Monrovia. This subcomponent will finance two micro-grids, a 2-3 MW PV micro-grid serving Voinjama (estimated population of 26,000 habitants) and a 1-2 MW hybrid small hydro-diesel micro-grid serving Zorzor (estimated population of 5,000 habitants). It will also finance the distribution lines to the populated areas and connections to the new customers (households and small businesses).

4.1.2 Subcomponent 1B: Solar lighting

This subcomponent will finance the continuation of the current Lighting Lives in Liberia project (LLL). It will further develop the distribution market of solar lanterns and small solar kits in the country with the procurement and purchase of solar equipment to be sold and

distributed by the already active eight retailers that are selling these products in the country.

4.2 COMPONENT 2: DEVELOPMENT OF SPECIFIC REGULATIONS FOR OFF-GRID ELECTRIFICATION

In the framework of the new Electricity Law and sectoral regulatory framework (currently under development), this component will finance technical assistance as needed to create the specific regulation to ensure the sustainability of the electricity services in the rural areas. The current regulation is focused mainly on the national grid, and the off-grid areas are relying on informal service providers offering an expensive and unreliable electricity service normally based in small diesel generators. The MLME will be the main implementing agency, but LEC and RREA will collaborate in providing technical inputs.

4.2.1 Subcomponent 2A: Establishment of an operation and maintenance contract to ensure the sustainability of the rural electricity service

This subcomponent will elaborate the business plan of the electricity service provision in Lofa County and will package a contract. This business plan will take into consideration the costs of services and the beneficiaries' capacity and willingness to pay and will determine different pricing levels and the tariff system as well as the subsidy requirements to ensure financial equilibrium for the operator.

4.2.2 Subcomponent 2B: Implementation of regulatory framework for electrical systems outside the grid

This subcomponent will support the GoL in carrying out a program of activities aimed at ensuring sustainability of the electricity sector in rural areas through capacity building and technical assistance in technical, financial, and contractual areas to key selected actors.

4.2.3 Sub-Component 2C: Preparatory studies

This subcomponent will support the preparation of other projects to build a robust pipeline for future funding. The studies will cover pre-feasibility stage, national planning, demand assessment, energy systems optimization, etc.

4.3 COMPONENT 3 PROJECT IMPLEMENTATION SUPPORT AND CAPACITY BUILDING

This component includes support to preparatory studies, capacity building and technical assistance to RREA, MLME and LEC and project implementation support.

Project Implementation support and Capacity-Building: The project will strengthen the technical capacity of the Rural Renewable Energy Agency (RREA) and the ministry of energy (MLME) in areas related to rural electrification and renewable energy, mainly in planning, regulation, project identification and project implementation. Other stakeholders like LEC and private companies will also benefit of capacity building in operation and maintenance aspects of rural electrification systems. Particularly RREA will benefit of the direct support of National Rural Electric Cooperative Association (NRECA), which is an experienced company in the area of rural electrification. NRECA will provide short and long term experts to pair with RREA staff and train on-the-job while the project is being implemented. This sub-component will also support project implementation including procurement, safeguards and monitoring and evaluation (M&E).

5 ENVIRONMENTAL IMPACT ASSESSMENT AND ANALYSIS

This chapter identifies the potential environmental and social impacts that may arise from the Project and its sub-projects in the Liberian context for the purpose of electricity generation, with particular attention being paid to clearing of sites, construction of access roads, mini-grid power plant (mini-hydro and diesel hybrid plant), solar photovoltaic plant, and associated transmission and distribution networks.

Impacts resulting from the construction and/or rehabilitation of the various types of power plants and the different access roads including the clearing of sites are discussed under section 5.1: General Construction Activities.

Impacts resulting from the operation of mini hydro power plants, diesel thermal plants and solar photovoltaic plants are discussed in sections 5.2, 5.3 and 5.4 respectively. While impacts of the transmission and distribution networks are presented in section 5.5.

An overall summary of SREP's positive and negative environmental and social impacts is presented through Table 5-3 in section 5.6.

5.1 GENERAL CONSTRUCTION ACTIVITIES

Below is a discussion of the impacts associated construction phase. The latter impacts are generally consistent for all construction activities such as the construction of structures and access roads due to the similarity of the works involved. Activity-specific impacts are also outlined whenever applicable. Due to the localized and temporary nature of rehabilitation and construction works, fast recovery is likely to take place especially if the project is small or if field activities are accomplished in stages, where only small parcels are disturbed at a time.

5.1.1 Air Emissions

Construction activities are usually associated with the release of fugitive particulate matter (PM) generated from land clearing, excavation and movement of earth materials, cut and fill

operations, contact of construction machinery with bare soil, and exposure of bare soil and soil piles to wind. The use of construction equipment and power generators is expected to release exhaust related pollutants such as carbon monoxide (CO), nitrogen oxides (NOx), sulfur oxides (SOx), particulate matter (PM) and hydrocarbons (HCs). The cleaning and rehabilitation of fuel oil tanks in oil supply facilities may generate volatile organic compound (VOC) emissions. Air emissions during the rehabilitation and construction phases tend to be confined to the immediate vicinity of the rehabilitation or construction site.

5.1.2 Noise

During construction, noise may be caused by the operation of pile drivers and demolition machines, earth moving and excavation equipment, generators, concrete mixers, cranes as well as fuel oil tank erection and pipe laying works. The increased noise level will impact construction workers and nearby residential areas. Nevertheless, the latter impact will be limited to the works' implementation phase and will cease when the works are complete. Table 5-1 shows typical noise levels encountered during construction activities.

Table 5-1: Noise levels during rehabilitation and construction works.

Equipment	*Typical maximum noise level at 15 m (dBA)*	*World Bank Guideline for acceptable noise leve*[6]
Concrete pouring trucks	87	Residential / Institutional / Educational Daytime: 55 dBA Nighttime: 45 dBA Industrial / Commercial Daytime and nighttime: 70 dBA
Cranes	86	
Air compressors	89	
Excavation equipment	90	
Welders	73	
Diesel locomotives	97	
Dump trucks	87	

5.1.3 Solid Waste

Large amounts of waste materials including cleared solid waste debris, backfill earthwork and other construction wastes will be generated during the rehabilitation and construction period. If the piling and transportation of these waste materials are not managed properly, they will block the traffic and contaminate the environment. Long term random piling may also deteriorate the air quality due to the flying dust and could result in respiratory

[6] Source: World Bank, 2007. General Environmental, Health and Safety Guidelines.

problems to the people living in proximal areas. Used lubricants, paints, oils and other chemicals may also pose risks if improperly handled and / or disposed including soil and groundwater contamination and health and safety hazards.

5.1.4 Water Quality

Surface water pollution may result from uncontrolled discharges into rivers, streams, lakes, etc., accidental spills of oil, runoff, erosion, and sediment transport. The latter impact is particularly significant when construction activities occur within or in close proximity to surface water such as in the case of the construction of hydropower structures. Nevertheless, waters disturbed by rehabilitation and construction activities are likely to recover when sediment is controlled and natural processes are permitted to replenish stream life. On the other hand, the storage of fuel oil near water bodies could lead to accidental oil spills and subsequent contamination of surface water that make take longer time to recover. In Liberia, surface water bodies are often used as a drinking water source as well as for bathing and washing. Polluted water flowing into surface water bodies could impact the aquatic organisms and affect the quality of life of downstream users when river waters are involved. Groundwater contamination may occur from percolation of oil and lubricants in soil.

5.1.5 Soil

During construction activities, soil erosion may be caused by exposure of soil surfaces to rain and wind during site clearing, earth moving, and excavation activities. Improper grading of plant and sub-station sites and tower locations may also cause drainage and erosion problems. The resulting soil particles may be transported into surface drainage networks affecting thus the quality of natural water systems and ultimately the biological systems using the waters. Water may accumulate in excavated pits potentially leading to the breeding of insects and other infectious organisms. Accidental spill of oil or lubricant may infiltrate soil and enter surface or groundwater.

5.1.6 Flora and Fauna

Stream pollution by sediments from construction activities often consists of suspended and settleable solid particles that may coat, bury, suffocate or abrade living organisms such as eggs, larvae, fish, etc. Many aquatic invertebrates and fish may undergo changes in

population density and community composition if high concentrations of suspended solids are encountered. Aquatic vegetation may be adversely affected by a reduction in photosynthesis due to high turbidity. Dredging may also increase turbidity and sediment load and reintroduce into suspension bottom sludge trapping toxic precipitates. The toxic sludge may be ingested or concentrated in marine plant and animal species and biologically magnified in food chains.

Pollution of freshwater bodies by accidental oil spills may have deadly effects on associated mammals, aquatic birds, fish, insects, microorganisms, and vegetation. In addition, the effects of spilled oil on freshwater microorganisms, invertebrates, and algae tend to move up the food chain and affect other species. Standing water such as marshes or swamps with little water movement are likely to incur more severe impacts than flowing water because spilled oil tends to "pool" in the water and can remain there for long periods of time. In calm water conditions, the affected habitat may take years to restore. Oil spills impacts on flowing water are usually less severe because the currents provide a natural cleaning mechanism.

The installation of power transmission lines and towers necessitates the clearing of tall trees of 4.5 m or more within the rights-of-way to prevent power outages through contact of branches with transmission lines and towers, ignition of forest fires, corrosion of steel equipment, blocking of equipment access and interference with critical grounding equipment. The construction of power generation facilities and access roads also requires the clearing of trees and vegetation. Therefore, construction activities may result in loss of plant cover, disturbance and loss of fauna habitats, weakening and degradation of soils, disturbance of the natural landscape and morphology. Thus, the adequate selection of the location of a facility or the right of way of transmission/ distribution lines and access roads can significantly reduce impacts on biodiversity.

5.1.7 Traffic

The main impact on road traffic will be during clearing of solid waste debris and excavation of soil for construction. Longitudinal excavation will cause narrowing of the road causing

increase in traffic, while the lateral crossing of roads may block them completely.

5.1.8 Health and Safety

Safety issues may arise during the rehabilitation and construction phases if community's access to works' site is not controlled. People may be injured by construction machinery or may fall in open trenches. During dam construction for hydropower generation, the safety of the structure must be ensured from the earliest exploration and design phases sudden dam failures during construction. Sediments also pose a potential health and safety problem as silts and other fine materials may be toxic or the materials may act as transport media for adsorbed toxic materials such as heavy metals or organics. Also, sediments reduce reservoir capacities, and increase flooding in downstream reaches of streams.

The construction of fuel supply facilities are associated with the risk of release of flammable material due to accidental damages to the fuel tanks from works-induced landslide or collapse of tall structures such as cranes, and broken pipelines from works-induced vibration.

5.1.9 Socio-Economics

Although the rehabilitation and construction phase will generate several short term job opportunities for the local people, negative implications on the socio-economics will prevail and will be related to potential loss of land or land use, interruptions to means of livelihood, disturbances to cultural resources, and influx of workers.

Land acquisition can impact local communities and their livelihoods, current landowners and/or current land users. Land acquisition that results in involuntary resettlement can complicate the social impact of the project. This is compounded when projects are located in countries where land tenure and ownership laws are tenuous and/or in situations where local communities or groups do not hold title to the land.

The installation of power transmission lines and towers in agricultural lands during harvest period may cause a temporary damage to the cultivated crops. The construction of solar and

thermal power stations and electricity transmission sub-stations may necessitate the acquisition of lands and is therefore potentially associated with social problems such as the loss of houses and structures on the land, loss of access to common resources and facilities, and the potential change in the livelihoods of the communities who lived on the land or used it for cultivation.

On the other hand, positive impacts may arise from the construction of access roads after the roads are ready for use: better roads will facilitate trading through easier access to resources and markets for local communities in longer term.

5.1.10 Physical Cultural Resources

Improperly sited projects can damage physical cultural resources and diminish its value. Moreover, unregulated and careless excavation works may destroy potential buried archeological remains. Damage to physical cultural resources constitutes a threat to social cohesion and eliminates the potential for its use in tourism business. If properly planned and sited, developments related to the Project activities will have no impact on the country's physical cultural resources.

5.2 OPERATION OF MINI-HYDROPOWER STATION

Mini-hydropower projects refer to projects of 100-1000 KW capacity. There are normally two ways of exploiting mini-hydropower schemes. The first is to build a dam and create a reservoir behind it from which water is taken to drive hydraulic turbines in the project's powerhouse. The second, called a run-of-river scheme involves the construction of a barrage or weir for head creation. In run-of-river schemes, water is taken directly from the river into a headrace which is a diversion channel or pipework carrying the water to a powerhouse where the turbines are installed. They are simplest and cheapest to develop, and help to avoid the environmental problems associated with reservoir creation. However, such schemes rely exclusively on the flow of the river and are therefore very sensitive to water flow fluctuations and do not operate in drought periods. In the Liberian situation rivers may flow year round, but the flow will be so low that no power can be produced.

Direct relationships frequently exist between sizes of hydropower projects and magnitudes

of environmental impacts with those involving the construction of a large dam having significant impacts and the smaller schemes, particularly mini-scale hydropower projects, having little or no impact if adequately planned, designed and managed. Therefore, while the nature of the impacts outlined below is similar to that of large scale projects, their significance is much lower in the context of mini-hydropower projects as will be pointed out in the discussion.

5.2.1 Air Emissions and Noise

The effect of replacing fossil-fuelled power generation technologies by hydropower projects has generally a positive impact on air quality. Nevertheless, in the case of dam construction, the reservoir can become a source of methane if it contains a great deal of organic material, such as in tropical rain forests where conditions are right for anaerobic fermentation. In the worst case, a hydropower plant can produce more greenhouse emissions, over its lifetime, than a similarly sized fossil-fuelled power plant. Noise may be generated by the operation of pump(s)/generator(s), if any.

5.2.2 Water Quality

Trapping of water behind a dam affects the physical and chemical characteristics of the water in the impoundment, upstream and downstream areas as well as the groundwater quality and levels in the region surrounding the reservoir. Water quality within the reservoir will be dependent on what happens upstream in terms of increased population settlement and economic development, and the retention time within the reservoir. Quality is usually affected by salt accumulation, eutrophication from nutrient loading, turbidity, pollution from agricultural, industrial and human wastes. The upstream river will experience the reservoir "backwater effect", which causes higher water levels. Basic impacts of this effect will be increased sedimentation, higher groundwater levels, slower water velocity, and increased flooding upstream. Furthermore, anaerobic conditions may occur in the deeper layers as organic material on the bottom of the reservoir decays, thus decreasing oxygen levels. In the downstream river, improved water quality is experienced as a result of trapping of sediments and nutrients behind the dam. However, the changed water flow and sediment load lead to erosion of riverbed as a result of "hungry water" (with reduced silt

loads) being released from the dam, and cave in river embankments and associated infrastructure (foundation of existing bridges, underwater cable crossings).

The significance of the negative impact on water quality is expected to be low due the mini-scale of the planned projects.

5.2.3 Soil

The new supply of hydroelectricity may attract people and industries to the catchment area. New construction to accommodate the expanding population may require clearing and grading of previously undeveloped land. Clearing of formerly vegetated slopes could create increased dislodgement of sediment during periods of heavy precipitation. Accumulation of sediment in rivers and reservoirs not only could affect water quality and the underlying ecosystem but also could shorten the economic life of power production from reservoirs.

5.2.4 Fauna and Flora

The inundation in a reservoir area displaces terrestrial animals which escape to nearby areas and may push receiving ecosystems to beyond their carrying capacity. Dams, barrages and weirs having no structures allowing fish passage block fish migration in the river, leading subsequently to changes in upstream and downstream species composition and even species loss. Flooded areas stimulate the growth of aquatic vegetation and subsequently the increase in aquatic lake-type fauna and reptiles and amphibians. People in neighboring villages that are not affected by the inundation may experience a plague of rodents and non-venomous reptiles that are flooded from inundated lands for a short period.

On another hand, the operation of a dam or barrage changes the upstream and downstream river flow regimes and affects water quality. A river's ecosystem and associated communities of plants and animals are a function of the flow, the quantity and character of the sediment in motion through the channel, and the character and composition of the materials that make up the bed and banks of the channel. Flood and/or discharge timing, duration and frequency are all critical for the survival of communities of plants and animals living downstream. Changed water flow and quality may therefore reduce or eliminate the riparian vegetation and cause a change or even loss at times of the aquatic habitat for fish

and other species. Such an impact is more significant in reservoir projects compared to barrage schemes because in the latter, the flow is only depleted in the reach between the diversion channel intake and the powerhouse location generating minimal interference with the natural flow regime.

Again, the significance of the negative impact on fauna and flora is expected to be low due the mini-scale of the planned projects.

5.2.5 Health and Safety

The establishment of a reservoir (in the case of dam construction) or a diversion channel (in the case of barrage construction) and the associated water management structures (canals, ditches, etc.) will create conditions fostering the establishment and spread of water related diseases such as encephalitis, malaria, cholera and typhoid, as well as bilharzias and malaria. Disease transmission will be facilitated by the increase in the humidity which will modify the local climate and create favorable habitat for insect disease vectors such as mosquitoes.

Safety issues associated with hydropower projects include the danger of slipping and falling into water, electrical shocks resulting from uncontrolled access to powerhouses and electrical systems, and the possibility of dam or barrage failure and subsequent flooding of lands and properties downstream.

5.2.6 Socio-Economics

The most significant negative impact from a hydropower project involving the creation of a reservoir is the displacement of the houses and economic activities encountered in the area to be flooded and the associated disruption of livelihoods. Road infrastructure and power transmission lines may also be inundated.

Nevertheless, the creation of a reservoir and improved electricity supply often results in a better access to the project area potentially contributing to economic development. Tourism activity may take place in the vicinity of the reservoir as a result of the improved access and the scenery. Fish accumulation in the reservoir may also take place, thus enhancing the local fishing activity. The flow in the downstream river is regulated, resulting in flood control

which would enhance agricultural activity downstream thus generating additional income to the local people.

5.2.7 Physical Cultural Resources

If properly sited, mini-hydropower projects will have no negative impacts on the country's physical cultural resources.

5.3 OPERATION OF DIESEL THERMAL POWER GENERATION PLANT

Analysis of impacts of possible thermal power supply in rural areas is focused on diesel fuel oil as a source of thermal power generation in the planned mini-hydro diesel hybrid plants. Considering the seasonality of hydro-electric power generation, diesel fuel oil is supposed to serve as a backup source of power generation source.

5.3.1 Air Emissions

Diesel exhaust is a complex mixture of gases and fine particles. The primary pollutants emitted from diesel engines include:[7]

- Particulate matter (PM)
- Carbon monoxide (CO)
- Nitrogen oxides (NOx)
- Hydrocarbons (HC) such as Polycyclic Aromatic Hydrocarbons (PAHs)
- Volatile organic compounds (VOCs)
- Other hazardous chemicals.

VOCs and NOx can react under appropriate conditions leading to the formation of ground level ozone, harmful to the public health, fauna and flora and can induce material corrosion.

Health studies show that exposure to diesel exhaust primarily affects the respiratory system and worsens asthma, allergies, bronchitis, and lung functions. Diesel exhaust exposure may also increase the risk of heart problems, premature death, and lung cancer.

7 Maryland Department of the Environment Diesel Emissions Health and Environmental Effects

Air emissions contribute to global warming and air quality deterioration, and may have negative impacts on fauna, flora and human health as discussed in later sections. Furthermore, acidic products of fossil fuel combustion can have negative effects on building-stone leading to the black, grimy appearance due to soot and SO_2 and the enhanced corrosion of limestone and marble due to sulfuric acid formed from deposited SO_2.

Table 5-2: Classification of Air Emissions Produced by Diesel Power Generation with their Relative Impacts

Type of Emission	*Pollutant Classification*[8]	*Environmental Impact*[9]
PM	Primary Criteria Pollutant	▪ Reduction in visibility ▪ Soiling of buildings and other materials ▪ Corrosive and erosive damage of materials ▪ Alteration of local weather ▪ Can damage human and animal health ▪ Cause retardation of plant growth*
NO_x	Primary Criteria Pollutant	▪ Contribution to smog formation ▪ Induce acidic depositions ▪ Contributes to the formation of ground level ozone ▪ Visibility reduction ▪ Injurious effect to plants (i.e. necrosis, growth retardation) and animals ▪ Have health impacts on humans (i.e. nose and eye irritation, pulmonary edema, bronchitis, and pneumonia)
VOC	Primary Non Criteria Pollutant	▪ Induction of ground-level ozone formation ▪ Direct adverse effects on plants, animals and humans ▪ Some can be carcinogenic
CO	Primary Criteria Pollutant	▪ Exposure to CO can reduce the oxygen-carrying capacity of the blood thus reducing oxygen delivery to the body's organs ▪ At extremely high levels, CO can cause death.
Hydrocarbons (PAH)	Primary Non Criteria Pollutant	▪ Ambiant PAH include substances that are probable carcinogens[10]
***Criteria pollutant refers to the fact health based criteria were used to establish National Ambient Air Quality Standards (NAAQSs) for the pollutant; while a primary pollutant refers to those**		

[8] Cooper, C.D., Alley, F.C. 2002. *Air Pollution Control A Design Approach.* Waveland Press, USA.
[9] IBID.
[10] European Commission, 2001. Ambiant air pollution by Polycyclic Aromatic Hydrocarbons. Position Paper.

Type of Emission	*Pollutant Classification*[8]	*Environmental Impact*[9]
pollutants directly emitted to the atmosphere[11]		

5.3.2 Noise

Principal sources of noise in diesel thermal power plants include the turbine generators and boilers and their auxiliaries such as reciprocating engines, fans and ductwork, pumps, compressors, condensers, piping and valves, motors, transformers, circuit breakers and cooling towers. Blowing safety valves are typically the loudest components in thermal power plants. Nevertheless, they rarely operate, but when they do, they can constitute a source of nuisance to the nearby employees, and to a lesser extent, to wildlife and the public.

5.3.3 Solid Waste

Low-volume solid wastes can result from small diesel thermal power plants. These include mainly oil filters and spare parts that may contain hazardous material. On the other hand, waste generated from the fuel oil storage may include tank bottom sludge as well as spill cleanup materials and soils contaminated with oil. Typically, sludge is composed of water, hydrocarbons, and various solids including sand, scale and rust and may pose ecological problems if improperly managed.

5.3.4 Water Consumption

Large quantities of cooling water are needed inside fossil fuel power generation stations for condensation of steam in turbines and cooling of combustion facilities. A direct cooled station of 2000 MW would need about 60 m3 of water per second available only at coastal sites in general. Inland sites need cooling towers and about 2 m^3 per second of water to replace evaporation losses. The withdrawal of such large quantities of water has the potential to compete with other important water uses such as agricultural irrigation or drinking water sources. It may also damage fish populations and other aquatic organisms however in a small area immediately around the intake.

In the case of this project, relatively small quantities will be needed. Thus the disturbance is expected to be minor.

[11] Cooper, C.D., Alley, F.C. 2002.

5.3.5 Water Quality

Water discharges in small diesel power plants consist of sanitary wastewater, in-plant drains, and storm water.

Small diesel generators barely use water. Yet, it is worth mentioning that sanitary wastewater is known to be high in organic matter which disturbs the receiving water quality and may cause eutrophication. In-plant drains may contain toxic chemicals originating from cleaning solutions and corrosives and potentially causing pH excursions in the receiving water body. Storm waters may be loaded with hydrocarbons some of which are toxic such as benzene, which can interfere with aquatic life. However, quick recovery is likely after short storm events.

5.3.6 Spills and Leakages

The storage and transfer of fuel oil and petroleum products terminals creates the potential for leaks or accidental releases inland or in the surface waters from tanks, pipes, hoses, and pumps during loading and unloading of products. Examples of accidental oil spills involve fuel tankers that come in distress or collide, oil well blowouts, pipeline ruptures, and explosions at storage facilities. Hydrocarbons entering the ecosystem through spills may eliminate vegetation due to their phytotoxic properties, and can become dangerous especially if they enter the food-chain since several of the more persistent compounds like polycyclic aromatic hydrocarbons are carcinogenic. Biological effects of oil spills on aquatic organisms include acute toxicity (lethal, sublethal, immediate effects), chronic toxicity (delayed effects), bioaccumulation (in mollusks like mussels) and tainting of seafood. The ability of animal and plant populations to recover varies among organisms. While abundant organisms with highly mobile young stages which are produced regularly in large numbers may repopulate a cleaned-up area rapidly, slow maturing, long-lived species with low reproductive rates may take many years to recover their numbers and age structure. In general, the rate of recovery in tropical or regions is relatively fast due to the warm temperatures enhancing oil biodegradation and subsequent attenuation.

5.3.7 Aquatic Fauna and Flora

Withdrawal and discharge with elevated temperature and chemical contaminants such as

biocides or other additives, if used, may affect aquatic organisms, including phytoplankton, zooplankton, fish, crustaceans, shellfish, and many other forms of aquatic life. Aquatic organisms drawn into water supply structures may be subjected to thermal, pressure and biocidal stresses and may be significantly harmed or killed at times by impingement on the intake screens or entrainment in the cooling water systems. Among small organisms, zooplankton is the most sensitive to damage produced by the water supply hardware because it has a larger size and complex organization compared to bacterio- and phytoplankton. Additionally, aquatic organisms may be entrapped in the intake canals. There may be special concerns about the potential impacts of cooling water intake structures located in or near habitat areas that support endangered species or where local fishery is active.

Thermal discharges decrease the level of dissolved oxygen (DO) in water which may be harmful to aquatic animals such as fish, amphibians and copepods. Thermal pollution may also increase the metabolic rate of aquatic animals resulting in more food consumption and food source shortages potentially causing sharp decrease in certain populations. Changes in the environment may also result in a migration of organisms to other more suitable environments. Biodiversity can be decreased as a result.

Acid deposition and the alteration of the pH of aquatic systems may lead to the acidification of surface water bodies particularly lakes and ponds harming thus the aquatic life. Contamination of water by heavy metals and toxic chemicals from ash residues such as copper and mercury is equally harmful to aquatic organisms and may accumulate and get biomagnified in species of mollusks, crustaceans, and fish that are harvested by humans.

5.3.8 Forests

Acid deposition of air emissions from thermal power generation including dry deposition of SO_2, NO_2, HNO_3 and particulate sulfate matter and wet deposition to surfaces may have harmful effects on forests. When a forest system is subjected to acid deposition, the foliar canopy can initially provide some neutralizing capacity. However, if the quantity of acid components is high, the neutralizing capacity is overcome altering the ability of the trees to tolerate other environmental stresses such as droughts, insects, and other air pollutants such

as ozone.

5.3.9 Vegetation and Crops

Air emissions have various effects on plants and crops classified as visible symptoms and non-visual or subtle effects. Visible symptoms are deviations from the normal healthy appearance of the leaves due to tissue collapse (necrosis) and loss of color (chlorosis). Air pollution may also cause physiological alterations such as early senescence, leaf drop, elongation of stem and leaf structures, and decreased yield of ornamental and fruit trees. The non-visual or subtle effects involve reduced plant growth and alteration of physiological and biochemical processes as well as changes in the reproductive cycle.

5.3.10 Health and Safety

Air emissions from thermal power plants are reportedly associated with harmful effects on humans' respiratory system particularly NOx, SO2 and fine PM. Another potential health hazard of power generation is cancer induced by substances such as polycyclic aromatic hydrocarbons. These are produced by incomplete burning of fossil fuels and are known carcinogens, particularly for lung cancer.

Occupational health and safety problems may arise from potential electrical shock accidents inside the facility and from the absence of mitigation measures for noise reduction. Other health and safety impacts include the exposure to high electric and magnetic fields inside the facility, the excessive heat near combustion facilities, and the entry to restricted areas during maintenance such as turbines, condensers and cooling water towers. Other potential negative impacts are associated with the inhalation of toxic dust, exposure to chemicals and the fire. The storage and transfer of fuel oil also poses a risk of fire and explosion due to its flammable and combustible nature. Chemical hazards may result from the dermal contact with fuels and inhalation of fuel vapors during fuel loading and unloading.

5.3.11 Socio-Economics

Positive impacts of the operation and maintenance of thermal power plants include the reliable and continuous supply of power (obviously subject to the availability of fuels) and the added income for the local people through new long-term employment opportunities

inside the plant. Further, power supply will contribute to the economic development of the area by attracting energy-intensive economic developments. The improvement in power supply may also increase the surface of cultivated areas in proximal regions due to the potential addition of agricultural pump sets.

5.3.12 Visual Intrusion

Visual intrusion may become an inevitable consequence depending on the scale of the power generation station due to the size of the cooling towers and boilers the height of which may reach 100 and 200 meters, respectively. Stack height may also reach 200 meters. As a result, if not properly mitigated by artificial hills or tree plantations, the latter facilities may become aneyesore. Additionally, the condensation of water vapor from stacks and cooling towers leads to the formation of a visible local plume and occasionally to the production of convective clouds.

5.4 INSTALLATION AND OPERATION OF OFF-GRID-SOLAR PHOTOVOLTAIC POWER GENERATION PLANTS

A photovoltaic (PV) cell is a solid-state device like a transistor or a microchip using the physical characteristics of a semiconductor such as silicon to turn the sunlight directly into electricity. Solar photovoltaic cells can only generate electricity when the sun is shining, and must therefore incorporate energy storage systems to provide off-grid power continuously.

Solar power is one of the most environmentally benign methods of generating electricity. Solar photovoltaic power plants do not generate any atmospheric emissions during operation. A photovoltaic installation makes no noise either. There might even be some benefits locally from the shade created by the arrays of solar collectors. Nevertheless photovoltaic systems do have little environmental impact particularly when life cycle implications are considered.

5.4.1 Indirect Air Emissions

Although solar photovoltaic power plants do not produce any atmospheric emissions during operation, PV devices use silicon as the predominant material which is very energy intensive to produce from its pure form. Indeed, lifetime analysis of photovoltaic systems

show a relatively high level of emissions of carbon dioxide and other atmospheric emissions as a result of the emissions from the predominantly fossil-fuel-fired power plants generating the electricity used in the production of the silicon.

5.4.2 Fauna and Flora

On a utility scale, solar PV projects require a significant amount of space more than that required by a fossil fuel power. Solar PV systems typically use at least five acres per MW. The exact amount depends on the location and type of the technology employed. Impacts to habitat due to the installation of solar PV systems also vary according to location and size of the project. PV system installation may cause significant impacts to wildlife and vegetation given the large tracts of land needed. Long-term displacement and fragmentation of habitat may occur as a result of the installation of the solar array.

The natural areas where solar projects are to be sited could be adversely impacted in the short-term from sedimentation and erosion caused during construction of the facilities. Often specific regions can have more than one solar array proposed and cumulative impacts to wildlife and vegetation need to be considered. Indicators of the potential presence of critical habitats include the presence of wetlands or known wildlife breeding or nesting areas. The presence of limited range endemic species may also be a strong indicator of a critical habitat.

5.4.3 Solid Waste

While solar modules can last up to thirty years, a significant quantity of material needs to be disposed of at the end of the life of the modules. Because modules can contain potentially hazardous materials and Liberia lacks adequate disposal facilities, consideration should be given at the start of a solar PV project as to how units will be disposed of at the end of their useful life., Furthermore, a life cycle analysis of batteries for stand-alone PV systems indicates that the batteries are responsible for most of the environmental impacts, due to their relatively short life span and their heavy metal content (Tsoutsos et al. 2005). Projects with battery storage must address disposal of batteries at the end of their useful life.

The large-scale deployment of solar cells will involve much larger quantities of semi-

conducting material than has been manufactured for micro-processors. Some newer semiconductor materials contain toxic elements like cadmium and cadmium telluride. The semiconductor is a stable material but it will be important to ensure that conditions cannot occur which would permit cadmium to enter the environment. This will be particularly important when a plant is decommissioned. The processes involved in the manufacture of both silicon and other solar cells involve toxic organic chemicals and these, too, have to be strictly contained.

5.4.4 Socio-economics

Solar PV projects can involve large tracks of land and therefore significant land acquisition. Land acquisition can impact local communities and their livelihoods, current landowners and/or current land users. Land acquisition that results in involuntary resettlement can complicate the social impact of the project. Solar projects impacting large amounts of agricultural land could have particularly significant impacts on people's livelihoods and raise issues related to the substitution of fuel for food.

5.4.5 Physical Cultural Resources

Projects may be located in an area with the potential for containing tangible cultural resources. In addition, a solar project may impact the cultural heritage of the area by changing the landscape and possibly the type of economic activity in the area (IFC, 2006).

5.4.6 Visual Intrusion

Visual impacts associated with solar PV projects typically concern the appearance of the solar modules and their interference with the character of the surrounding landscape, particularly to nearby residential communities. Additionally, sometimes reflection from the module surfaces exacerbates visual impacts from a project. Consideration should be given to the landscape character during siting and visual impacts from relevant viewing angles.

5.5 POWER TRANSMISSION AND DISTRIBUTION

The electricity power transmission system includes the transmission line, its right of way (ROW), switchyards, sub-stations and access or maintenance roads. The principle structures of the transmission line include the line itself, conductors, towers and supports etc. The

width of the ROW ranges from 12 to 100 meters depending on voltage. Below are the major environmental and social impacts associated with the operation of power transmission and distribution structures.

5.5.1 Land Resources

Electric power transmission systems have a great impact on land resources. Although ROWs are generally not very wide, they can interfere with, or fragment existing land uses along the ROW particularly that a strip of around 3 meters should be kept clear for maintenance purposes. Further, transmission lines can open up more remote lands to human activities such as settlement, agriculture, hunting, recreation etc. These effects can be significant if natural areas such as wetlands or wild lands are affected or if newly accessible lands are home of indigenous people.

On another hand, land contamination by oil leakages through the joints of sub-station transformers may occur due to defective packing and improper tightening.

5.5.2 Noise

Unusual noise from transformers may occur due to loss of core-bolts, core plates, coil clamps, loose external fittings and mechanical forces due to short circuits.

5.5.3 Fauna and Flora

Clearing of vegetation from ROWs using broadcast aerial spraying of herbicides affords no selectivity and releases unnecessarily large amount of chemicals into the environment that may potentially lead to the elimination of desirable species and direct poisoning of wild life. However, properly managed ROWs can provide feeding and resting sites for birds and mammals. Power lines and structures can serve as nesting sites and perches for many birds. On the other hand, avian collisions with power lines can occur in large numbers if located within daily flyways or migration corridors, or if groups are traveling at night or during low light conditions (e.g. dense fog).

5.5.4 Health and Safety

The use of broadcast aerial spraying of herbicides for the purpose of ROW clearing may

result in the contamination of surface waters and terrestrial food chains. Placement of lines near human activity increases the risk for electrocution. Additionally, the electric power transmission lines create electromagnetic fields (EMF) which may pose health hazards depending on the lines' voltage strength. However, power frequency EMF typically has a frequency in the range of 50 – 60 Hertz (Hz), and is considered Extremely Low Frequency (ELF). Although there is public and scientific concern over the potential health effects associated with exposure to EMF, there is no empirical data demonstrating adverse health effects from exposure to typical EMF levels from power transmissions lines and equipment. However, while the evidence of adverse health risks is weak, it is still sufficient to warrant limited concern (World Bank 2007d). Fire hazards may also occur due to ignition of insulating oil in the oil filled switchgears and transformer units. Unchecked growth of tall trees and accumulation of vegetation within ROWs may also result in the ignition of forest fires.

5.5.5 Socio-Economics

When a power line passes parallel to telecommunication lines, electrical interferences are caused to telecom lines due to electromagnetic inductions. Besides, the installation and operation of power transmission and distribution structures may result in the depreciation of the price of immediately adjacent lands and properties. Nevertheless, the increased availability of power supply in areas facing previously electricity shortage and / or absence of supply will open up the latter areas for new settlements and economic developments and improve the standard of living and well-being of their residents.

5.6 SUMMARY OF IMPACTS

Table 5-3 presents a summary of the significance and frequency of occurrence of potential environmental and social impacts arising from the implementation of the Project's activities. The table clearly shows that different alternatives have distinct impacts, with renewable energy schemes appearing to be particularly benign from an environmental and socio-economic perspective.

Table 5-3: Summary of positive and negative impacts of SREP activities for power generation in rural Liberia

Activity \ Emissions / Receptors	Impact significance and frequency of occurrence															
	Air emissions	Noise	Solid waste	Water consumption	Water quality	Land resources	Soil	Terrestrial fauna & flora	Aquatic fauna and flora	Vegetation and crops	Traffic	Labor health and safety	Community health and safety	Socio-economics	Visual intrusion	Physical Cultural Resources
Construction of a mini-hydropower station	-/0	-	-/0	0	-	-/0	-	0	-	-/0	0	-/0	-/0	-/+	-	-/0
Operation of a mini-hydropower station																
Reservoir scheme	-/0	-/0	0	0	-/0	-	-/0	-	- -	-	0	-/0	-/0	-/+	0	-/0
Run-of-river scheme	0	-/0	0	0	-/0	0	-/0	0	-	0	0	-/0	-/0	++	0	-/0
Construction of a diesel thermal power generation plant	-/0	--	-	0	-/0	-/0	-	-/0	0	-/0	-/0	-/0	-/0	-/+	-	-/0
Operation of a diesel thermal power generation plant	- -	-	-	-	-/0	0	-/0	-/0	-	-/0	0	-	-/0	++	-/0	-/0
Installation and operation of off-grid solar photovoltaic power generation systems	+	0	0	0	0	-/0	-/0	0	0	0	0	-/0	-/0	-/+	-/0	-/0
Rehabilitation/construction of power transmission and distribution facilities	-/0	- -	-/0	0	-/0	-	-	-	0	-/0	-/0	-/0	-/0	-/+	-	-/0
Operation of power transmission and distribution facilities	0	-/0	0	0	0	-	-/0	-/+	0	-/0	-	-	- -	++	-/0	-/0
Operation of distribution facilities	0		0	0	0	-/0	0	-/+	0	0	0	-	-	0/+	-/0	-/0

*Key:	0: No significant impact; + + +: High positive impact; + +: Moderate positive impact; +: Low positive impact; - - -: High negative impact; - -: Moderate negative impact; -: Low negative impact;		
	Frequently occurring impact		Rarely occurring or short-term impact

6 IMPACT MITIGATION AND ENVIRONMENTAL& SOCIAL MANAGEMENT AND MONITORING PLAN

6.1 MITIGATION MEASURES

The potential environmental impacts that may be associated with the implementation of project for the purpose of electricity generation can be minimized by careful site/ right of way selection, planning and staging of construction activities, adopting proper management practices during operation and relying on effective environmental monitoring and training to support management decisions. This chapter plan proposes several potential impact-mitigation or control measures that should earn the proposed project more acceptability, by reducing or eliminating to the extent possible many of the impacts that have been discussed in Section 5. Mitigation measures are intended to reduce the effect of potentially significant impacts on the environment. Thus, they are highly dependent on the significance of the predicted impact, the nature of the impact (permanent vs. temporary), or the phase of the project (construction vs. operation). Accordingly, the mitigation measures presented below are generic, and need to be refined and adapted to each of the proposed energy projects, once the detailed project components are available.

Table 6-1 to Table 6-5 present a summary of the proposed mitigation measures for the potential environmental and social impacts arising from the implementation of the SREP sub-projects. The tables also indicate where responsibility lies for implementation.

These tables will be used to develop appropriate mitigation measures as the sub-project schemes are developed and, as shown in Appendix D, to develop the EHS Contract Clauses to be included in the works contracts.

With respect to the cost of the mitigation, it will be allocated as such:

- During the design phase, mitigation cost will be included in the final design preparation
- During the construction phase, mitigation cost will be included with construction costs
- During operation, mitigation costs will be part of the operation costs

- The schedule of implementation of the mitigation measures will be consistent with the project execution phases.

It should be noted that the mitigation measures referred to in the below table are generic measures, meaning they will only require action once specific projects are identified and assessed. Similarly, the cost of the mitigation activities would be assessed as part of the rehabilitation or construction works to be conducted by the contractors under the specific sub-project. The bidding documents of the contractors would be reviewed to ensure that the recommendations set forth herein are reflected and their implementation adequately included in the overall price of the works. At present, it is not possible to assess specific mitigation measures or their cost as the potential future sub-projects to be implemented are unknown. As the future works become clear, the measures and their cost shall be reflected either in an updated ESMF or in specific Environmental Assessments and/or Environmental Management Plans, as well as the relevant bidding documents.

Table 6-1: Summary of proposed mitigation measures for general construction and/or rehabilitation activities.

Impact	*Mitigation Measures*	*Responsibility*
GENERAL CONSTRUCTION AND/OR REHABILITATION ACTIVITIES		
Air quality	❑ Watering of surfaces and/or chemical stabilization ❑ Reduction of surface wind speed with windbreaks or source enclosures ❑ Covering the road surface with a new material of lower silt content ❑ Grading of gravel roads ❑ Proper site enclosure through appropriate hoarding and screening; ❑ On-site mixing and unloading operations; ❑ Proper handling of cement material; ❑ Maintaining minimal traffic speed on-site and on access roads to the site; ❑ Covering all vehicles hauling materials likely to give off excessive dust emissions; ❑ Ensuring adequate maintenance and repair of construction machinery and vehicles; ❑ Avoiding burning of material resulting from site clearance; ❑ Covering any excavated dusty materials or stockpile of dusty materials entirely by impervious sheeting; ❑ The provision of water troughs at entry and exit points to prevent the carryover of dust emissions, beyond the construction site ❑ Proper truck maintenance ❑ The adoption of a traffic management plan while avoiding congested routes ❑ The adoption of proper maintenance procedures for on-site construction equipment and the use of diesel fuel of acceptable ❑ Turning off equipment when not in use	Consultant/ Contractor
Noise	❑ Enclosing the site with barriers/fencing ❑ Effectively utilizing material stockpiles and other structures to reduce noise from on-site construction activities ❑ Choosing inherently quiet equipment ❑ Operating only well-maintained mechanical equipment on-site ❑ Keeping equipment speed as low as possible ❑ Shutting down or throttling down to a minimum equipment that may be intermittent in use ❑ Utilizing and properly maintaining silencers or mufflers that reduce vibration on construction equipment ❑ Restricting access to the site for truck traffic outside of normal construction hours ❑ Proper site logistics and planning ❑ Limiting site working hours if possible ❑ Scheduling noisy activities during the morning hours ❑ Informing the locals when noisy activities are planned ❑ Enforcing noise monitoring	Consultant/ Contractor

Impact	*Mitigation Measures*	*Responsibility*
Solid waste (construction waste, chemical waste, general refuse)	❑ Use of generated construction debris materials for reclamation purposes whenever applicable, after ensuring the absence of contamination and the adequacy of the physical and chemical properties of such material ❑ Minimization of construction and demolition wastes through careful planning during the design stage, whereby reducing or eliminating over-ordering of construction materials ❑ Sorting of construction and demolition wastes into various categories and adopting re-use/recycle on site whenever deemed feasible. ❑ Segregating chemical wastes and properly storing and disposing of it as hazardous waste. ❑ Storing chemical wastes in a separate area that has an impermeable floor, adequate ventilation and a roof to prevent rainfall from seeping ❑ Clearly labeling all chemical waste in English and Liberian, storing it in corrosion resistant containers and arranging so that incompatible materials are adequately separated ❑ Securing a prior agreement with the EPA for the disposal of hazardous waste generated on-site ❑ Drafting an agreement should with the solid waste collector in the county where the project is being implemented to identify collection sites and schedule the removal to minimize odor, pest infestation and litter buildup ❑ Prohibiting the burning of refuse on the construction site ❑ Promoting recycling and reuse of general refuse.	Consultant/ Contractor
Surface water	❑ Provide channels, earth bunds or sand bag barriers to properly direct storm water to silt removal facilities ❑ Use adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins before discharge into the surrounding waters ❑ Maintain silt removal facilities by regularly removing deposited silt and grit ❑ Discharge rainwater pumped out from trenches or foundation excavations into storm drains via silt removal facilities and not directly to the aquatic environment ❑ Cover open stockpiles of construction materials on site with tarpaulin or similar fabric during rainstorm events to prevent the washing away of construction materials ❑ Compact earthworks as soon as the final surfaces are formed to prevent erosion especially during the wet season ❑ Collect and connect water used in vehicle and plant servicing areas to foul sewers via an oil/grease trap. Oil leakage or spillage should be contained and cleaned up immediately ❑ Collect spent oil and lubricants and store them for recycling or proper disposal ❑ Prepare guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel or chemicals. ❑ Contain sewage from toilets, kitchens and similar facilities in sanitary cesspools before being transported by trucks to a	Consultant/ Contractor

Impact	*Mitigation Measures*	*Responsibility*
	nearby wastewater treatment plant	
Soil and groundwater	❑ Proper storage of chemicals on site ❑ The installation of natural or synthetic liners beneath chemical storage tanks ❑ Proper surface drainage during both the construction and operation phases ❑ Minimization of on-site water and chemical usage (oil, lubricants and fuel) ❑ Limiting the exposure of the soil to accidental releases of pollutants ❑ Use of non-toxic and readily biodegradable chemicals on-site	Consultant/ Contractor
Flora and Fauna ***Erosion***	❑ Scheduling construction/ rehabilitation to avoid heavy rainfall periods (i.e., during the dry season) to the extent practical ❑ Contouring and minimizing length and steepness of slopes ❑ Mulching to stabilize exposed areas ❑ Re-vegetating areas promptly ❑ Designing channels and ditches for post-construction flows ❑ Lining steep channel and slopes (e.g. use jute matting) ❑ Reducing or preventing off-site sediment transport through use of settlement ponds, silt fences, and water treatment, and modifying or suspending activities during extreme rainfall and high winds to the extent practical ❑ Restricting the duration and timing of in-stream activities to lower low periods, and avoiding periods critical to biological cycles of valued flora and fauna (e.g., migration, spawning, etc.) ❑ For in-stream works, using isolation techniques such as berming or diversion during construction to limit the exposure of disturbed sediments to moving water	Consultant/ Contractor
Dredging	❑ Adoption of construction sequencing and work procedures to minimize streambed disturbance ❑ Control of the rate of dredging to minimize the sediment loss rate ❑ Use of tightly closing grabs during dredging, to restrict the loss of fine sediment to suspension ❑ Careful loading of barges to avoid splashing of material	
Land clearing	❑ Use of barges for the transport of dredged materials that are fitted with tight bottom seals in order to prevent leakage of material during loading and transport ❑ Filling of barges to a level which ensures that materials do not spill over during loading and transport and that adequate freeboard is maintained to ensure that the decks are not washed by wave action ❑ Control of the speed of the trailer dredger within the works area to prevent propeller wash from stirring up the seabed sediments ❑ Building of suitable barriers to intercept the transport of SS away from the project area	

Impact	*Mitigation Measures*	*Responsibility*
	❑ Scheduling dredging activity during periods that don't interfere with fish spawning or intense migration ❑ Select right-of ways to avoid important natural areas such as wild lands and sensitive habitats ❑ Utilize appropriate clearing techniques (hand clearing vs. mechanized clearing) ❑ Maintain native ground cover beneath lines ❑ Replant disturbed sites ❑ Manage right-of-ways to maximize wildlife benefits	
Traffic	❑ Proper planning and development of a traffic control plan that takes into account the reservations and inputs of local communities ❑ Proper dissemination of information regarding the construction schedule ❑ Providing alternate routes when needed and when feasible during all phases of construction ❑ Ensuring safety of motorists through adequate warning, signing, delineation and channeling at least 500 m down and up-gradient from the construction site ❑ Limiting the movement of heavy machinery during the construction phase to off-peak hours and providing prior notification ❑ Providing a traffic re-routing plan for the construction phase at the bidding stage	Consultant/ Contractor
Health and safety	❑ Restriction of access to the construction site by proper fencing ❑ Establishment of buffering areas around the site ❑ Provision of guards on entrances and exits to the site ❑ Installation of warning signs at the entrance of the site to prohibit public access ❑ Provision of training about the fundamentals of occupational health and safety procedures ❑ Provision of appropriate personal protective equipment (PPE) (impermeable latex gloves, working overalls, safety boots, safety helmets, hearing protecting devices for workers exposed to noise levels exceeding 90 dBA[80], and lifesaving vests for construction sites near water bodies) ❑ Ensuring that workers can swim and that lifesaving rings are available at the worksite, near water ❑ Ensuring that the protective material is being used wherever it is required ❑ Ensuring that especially sensitive or dangerous areas (like areas exposed to high noise levels, areas for especially hazardous work etc.) are clearly designated ❑ Ensuring that all maintenance work necessary for keeping machines and other equipment in a good state will be regularly carried out.	Consultant/ Contractor

[80] The maximum allowable 8-hour occupational noise standard set by OSHA

Impact	*Mitigation Measures*	*Responsibility*
	❑ Ensuring that the workers are qualified, well trained and instructed in handling their equipment, including health protection equipment. ❑ Provision of adequate loading and off-loading space ❑ Development of an emergency response plan ❑ Provision of on-site medical facility/first aid ❑ Provision of appropriate lighting during night-time works ❑ Implementation of speed limits for trucks entering and exiting the site ❑ Ensuring that hazardous substances are being kept in suitable, safe, adequately marked and locked storing places ❑ Ensuring that containers of hazardous substances are clearly marked, and that material safety data sheets are available ❑ Ensuring that all workers dealing with hazardous substances are adequately informed about the risks, trained in handling those materials, and trained in first aid measures to be taken in the case of an accident ❑ Designating an area where contaminated materials and hazardous waste can be stored for proper disposal according to environmental guidelines ❑ The adoption of good housekeeping practices for ensuring hygiene on site ❑ The elimination of pools of stagnant water, which could serve as breeding places for mosquitoes ❑ The provision of bednets for workers living on site. ❑ The appropriate elimination of waste of all types, including wastewater ❑ The provision of a safety specialist responsible for the preparation, implementation and maintenance of a comprehensive safety program ❑ For the rehabilitation and/or construction of fuel supply facilities, provision of fire-fighting equipment such as dry powder extinguishers ❑ Conducting firefighting and leak checks training drills for the construction staff ❑ Prohibition of smoking as well as litter or weed build up in the area as these may pose fire risks	
Socio-economics	❑ Select project site and rights-of-way (ROW) to avoid important social, agricultural, and cultural resources and avoid areas of human activity ❑ Utilize alternative designs to reduce land and ROW width requirements and minimize land use impacts ❑ Ensure a high rate of local employment to minimize influx of foreign contract workers ❑ Manage resettlement in accordance with World Bank Procedures.	Consultant/ Contractor
Landscape and visual impacts	❑ Enclose the site with non-transparent fencing to minimize the visual impacts on nearby areas ❑ Prohibit the parking of construction equipment, construction materials, and transport vehicles outside the fenced boundary	Consultant/ Contractor

Impact	*Mitigation Measures*	*Responsibility*
	of the construction site	
Physical cultural resources	❑ Conduct appropriate project siting at the planning stage to avoid physical cultural resources and touristic sites ❑ Adopt, 'Archaeological Chance Find Procedures' particularly where excavation works will take place (Appendix D)	Consultant/ Contractor

Table 6-2: Summary of proposed mitigation measures for the construction and operation of a mini-hydropower station.

Impact	*Mitigation Measures*	*Responsibility*
CONSTRUCTION & OPERATION OF A MINI-HYDROPOWER STATION		
Air and noise quality	❑ Choosing the site carefully and clearing the flora before inundation to minimize methane emissions due to organic material decomposition in the reservoir ❑ Siting of new facilities by taking into consideration the distances between the noise sources and nearby sensitive receptors ❑ Use of noise control techniques such as: using acoustic machine enclosures; using mufflers or silencers; using sound absorptive materials in walls and ceilings; using vibration isolators and flexible connections; ❑ Use of noise barriers such as berms and vegetation to limit ambient noise at plant property lines, especially where sensitive noise receptors may be present; ❑ Provision of the necessary PPE for workers on-site	Consultant/ Contractor/ Operator/ RREA
Water quality	❑ Clearance of woody vegetation from inundation zone prior to flooding ❑ Regulation of water discharge and manipulation of water levels to discourage weed growth ❑ Control of land uses, wastewater discharges, and agricultural chemical use in watershed ❑ Limiting of retention time of water in reservoir ❑ Provision of multi-level releases to avoid discharge of anoxic water ❑ Hydraulic removal of sediments from reservoir by flushing, sluicing, and/or release of density currents ❑ Operation of reservoir to minimize sedimentation; ❑ Regulation of dam releases to partially replicate the natural flooding regime; ❑ Maintenance of at least minimum flow to maintain groundwater recharge.	Consultant/ Contractor
Soil	❑ Limiting access of people to the project area ❑ The development of basin-wide integrated land-use planning to avoid overuse, misuse, and conflicting use of water and land resources.	Consultant/ contractor RREA
Fauna and flora	❑ Determine and maintain a 'reserved flow' downstream of a water diversion work ❑ Perform river rehabilitation and river restructuring works (growing trees on the riverbanks, gravel deposits in the streambed, reinforcement of the riverside through shrubs to fight erosion, the construction of pools for fish breeding, meandering low water riverbeds, modification of the slope, etc.) ❑ Secure appropriate upstream fish passage for fish migration through fish ladders (natural-like creek without steps, pool and weir, Denil-passes, vertical slots, hybrid), lifts (elevators or locks), pumps and transportation	Consultant/ contractor Operator/ RREA

Impact	*Mitigation Measures*	*Responsibility*
	operations ❑ Secure appropriate downstream fish passage by using an innovative self-cleaning static intake screen that uses the Coanda effect ❑ Using behavioral guidance systems (strobe lights for repelling fish, mercury lights for attracting fish, a sound generating device known as "hammer" for repelling fish as well as quite a number of electrical guidance systems) to divert or attract downstream migrants ❑ When the screen is located in the intake downstream of the entrance, install a bypass at the downstream end of the screen to return the fish to the river. ❑ Bypass entrance should be a minimum of 45 cm – Bypass entrance should be a minimum of 45 cm – The bypass entrance design should provide for smooth flow acceleration into the bypass conduit with no sudden contractions, expansions or bends – To return fish from the bypass entrance back to the river, fully closed conduits or open channels can be used – Conduit discharge velocities close to 0.8 m/sec are recommended ❑ Regarding the impact on terrestrial animals, bury open canals entirely and repopulate with vegetation so they do not represent any barrier ❑ If open canals are opted for, use ladder constructions to help animals that may fall into an open canal to get out	
Visual intrusion	❑ Screen most of the components comprising a hydro-power plant from view using landscaping and vegetation ❑ Paint components in non-contrasting colors and textures to obtain non-reflecting ❑ Use every natural feature- rocks, ground, vegetation - to shroud the penstock or paint it so as to minimize contrast with the background ❑ Bury the penstock if possible to reduce or eliminate expansion joints and concrete anchor blocks, return the ground to its original state and eliminate the barrier to the passage of wildlife	Consultant/ contractor
Health and safety	❑ Design and operation of water management structures to decrease habitat for vector ❑ Applying appropriate vector control measures, disease prophylaxis and treatment ❑ Use of signs, barriers (e.g. locks on doors, use of gates, use of steel posts surrounding transmission towers, etc.), and education / public outreach to prevent public contact with potentially dangerous equipment; ❑ Grounding conducting objects (e.g. fences or other metallic structures) installed near power lines, to prevent shock. ❑ Periodic maintenance of signs and structures	Consultant/ contractor Operator/ RREA

Impact	*Mitigation Measures*	*Responsibility*
	❑ Regular training on emergency response plan	
Socio-economics	❑ Relocation of people to suitable areas ❑ Avoid disruption of tribal/indigenous groups by avoiding dislocation of unacculturated people ❑ Provision of compensation in kind for resources lost ❑ Maintenance of standards of living by ensuring access to resources at least equaling those lost ❑ Provision of adequate health and social services, infrastructure, and employment opportunities	Consultant/ contractor
Physical cultural resources	❑ Proper siting of a hydropower plant to avoid loss of historic and cultural properties	Consultant/ contractor

Table 6-3: Summary of proposed mitigation measures for the operation of diesel fuel power plant

Impact	*Mitigation Measures*	*Responsibility*
	OPERATION OF A DIESEL FUEL POWER PLANT	
Air quality	❑ Use of the cleanest diesel fuel economically available that is consistent with the overall energy and environmental policy of Liberia ❑ Select the best power generation technology for the fuel chosen to balance the environmental and economic benefits ❑ Design stack heights according to Good International Industry Practice (GIIP) ❑ Ensure that emissions from a single project do not contribute more than 25% of the applicable ambient air quality standards ❑ Use specific air emission control technologies (for SO2, NOx, PM, etc.) to meet air pollution emission standards	Consultant/ Contractor Operator/ RREA
Noise	❑ Siting of new facilities by taking into consideration nearby sensitive receptors ❑ Use of noise control techniques such as: – using acoustic machine enclosures – selecting structures according to their noise isolation effect to envelop the building – using mufflers or silencers in intake and exhaust channels – using sound absorptive materials in walls and ceilings – using vibration isolators and flexible connections – applying a carefully detailed design to prevent possible noise leakage through openings or to minimize pressure variations in piping; ❑ Modification of the plant configuration or use of noise barriers such as berms and vegetation to limit ambient noise at plant property lines, especially where sensitive noise receptors may be present; ❑ Provision of the necessary PPE for workers on-site	Consultant/ Contractor Operator/ RREA
Solid waste	❑ Management of low-volume wastes in surface impoundments. ❑ Provision must be made for suitable separation and storage of waste in designated and labeled areas ❑ Solid waste should be collected in protected storage units, sorted (if possible) and disposed at approved site ❑ Worker training should include instructions on how to dispose the different types of waste in separate containers emphasizing the need to protect the environment	Consultant/ Contractor Operator/ RREA
Spills and Leakages	❑ Ensure that storage tanks and components meet international standards for structural design integrity and operational performance to avoid catastrophic failures ❑ provisions for overfill protection, metering and flow control, fire protection ❑ Overfill protection equipment include level gauges, alarms, and automatic cutoff systems. ❑ the use of "breakaway" hose connections in fuel dispensing equipment which provide emergency shutdown of flow should the fueling connection be broken through movement ❑ Storage tanks should have appropriate secondary containment.	Consultant/ Contractor Operator/ RREA

Impact	*Mitigation Measures*	*Responsibility*
	❑ use of double bottom and double wall containment, impervious linings underneath tanks, or internal tank liners ❑ Installation of impervious asphalt or concrete surfaces with polyethylene sheeting underneath in areas of potential petroleum leaks and spills, including below gauges, pipes, and pumps, and below rail and truck loading / unloading areas ❑ Perform periodic inspection of storage tanks and components ❑ Conduct loading / unloading activities by properly trained personnel according to pre-established formal procedures to prevent accidental releases and fire /explosion hazards ❑ Develop a spill prevention and control plan that addresses significant scenarios and magnitudes of releases.(Oil Spill Response Plan is found in Appendix E) ❑ Locate Above Ground Storage Tanks (ASTs) in a secure area, protected from potential collisions by vehicles, vandalism, and other hazards	
Water consumption	❑ Using a closed-cycle, recirculating cooling water system (e.g., natural or forced draft cooling tower), or closed circuit dry cooling system (e.g., air cooled condensers) if necessary to prevent unacceptable adverse impacts ❑ Use of once-through cooling water systems may be acceptable if compatible with the hydrology and ecology of the water source and the receiving water and may be the preferred or feasible alternative for certain pollution control technologies such as seawater scrubbers. ❑ Use of air-cooled systems	Consultant/ Contractor Operator/ RREA
Water quality	❑ Pretreatment of cooling tower makeup water, installation of automated bleed/feed controllers, and use of inert construction materials to reduce chemical treatment requirements for cooling towers; ❑ Elimination of metals such as chromium and zinc from chemical additives used to control scaling and corrosion in cooling towers; ❑ Use the minimum required quantities of chlorinated biocides in place of brominated biocides or alternatively apply intermittent shock dosing of chlorine as opposed to continuous low level feed. ❑ Divide the waste in three fractions and store it in clearly marked separate tanks, including used lubricant oil, used diesel oil with little or no water content, other oily waste with varying water content ❑ Make provisions in coordination with the EPA and the local authorities regarding sanitary wastewater treatment and disposal	Consultant/ Contractor Operator/ RREA
Aquatic fauna and flora	❑ Design the water intake and discharge based on the study of the surface water hydrology of the water body – For lakes or reservoirs, intake flow must not disrupt the thermal stratification or turnover pattern of the water source – For estuaries or tidal rivers, reduction of intake flow to 1% of	Consultant/ Contractor Operator/

Impact	*Mitigation Measures*	*Responsibility*
	the tidal excursion volume ❑ Reduction of impingement and entrainment of fish and shellfish by the installation of technologies such as barrier nets (seasonal or year-round), fish handling and return systems, fine mesh screens, wedge-wire screens, and aquatic filter barrier systems ❑ Reduction of impingement and entrainment by implementing seasonal shutdowns, reductions in flow or continuous use of screens, designing the location of the intake structure in a different direction or further out into the water body ❑ Use an alternative heat dissipation design such as a closed cycle cooling; ❑ Dilute the thermal condition by discharging water into larger receiving water bodies; ❑ Install mechanical diffusers; ❑ Cool water on-site in a holding pond prior to discharge; ❑ Explore opportunities to use waste heat.	RREA
Forests, vegetation, and crops	❑ Apply appropriate air pollution control technology at the power plant	Consultant/ Contractor
Health and safety	❑ Develop and implement a worker health and safety plan to include: – Identification of potential exposure levels to electric and magnetic fields (EMF) in the workplace; – Training of workers in the identification of occupational EMF levels and hazards; – Establishment and identification of safety zones where EMF levels are acceptable for public exposure; – Limiting exposure time to EMF through work rotation, increasing the distance between the source and the worker, when feasible, or the use of shielding materials. – Regular inspection and maintenance of pressure vessels, piping; and related hot equipment; – Provision of adequate ventilation in work areas to reduce heat and humidity; – Reducing the time required for work in elevated temperature environments and ensuring access to drinking water; – Shielding surfaces where workers come in close contact with hot equipment, including generating equipment, pipes etc; – Use of warning signs near high temperature surfaces and personal protective equipment (PPE) as appropriate, including insulated gloves and shoes. – Provision of sound-insulated control rooms with noise levels below 60 dBA; – Design of generators to meet applicable occupational noise levels (< 90 dBA); – Identification and marking of high noise areas and requiring that personal noise protecting gear is used all the time when working there (typically areas with noise levels >85 dBA)	Consultant/ Contractor Operator/ RREA

Impact	*Mitigation Measures*	*Responsibility*
	– Considering installation of hazard warning lights inside electrical equipment enclosures to warn of inadvertent energization; – Use of voltage sensors prior to and during workers' entrance into enclosures containing electrical components; – Deactivation and proper grounding of live power equipment and distribution lines according to applicable legislation and guidelines whenever possible before work is performed on or proximal to them; – Provision of specialized electrical safety training to those workers working with or around exposed components of electric circuits; – Use of automated combustion and safety controls;	
Socio-economics	❑ Apply appropriate air pollution control measures to mitigate negative impacts of diesel fuel combustion on building stone ❑ Develop an infrastructure plan and secure financial support for increased demand on infrastructure associated with the improvement in power supply	Consultant/ Contractor Operator/ RREA/ Government
Visual intrusion	❑ Enclose the site with non-transparent fencing ❑ Preserve existing vegetation when feasible ❑ Select construction materials that will blend with the background ❑ Select architectural designs that will blend with the surrounding features of the milieu ❑ Select appropriate paint colors for the exterior of the plant to help it blend with the surroundings ❑ Incorporate underground utilities (to the extent possible) to house electrical, storage, and operational equipment ❑ Ensure that open areas adjacent to the erected structures are grassed and planted with shrubs, trees and ground covers ❑ Select and enforce designs that will maximize the unbarred view of the sea (when applicable) from most areas within the region of influence ❑ Avoid onsite storage of construction spoils ❑ Remove wastes and debris weekly from the landscaped areas ❑ Maintain landscaped areas sufficiently in order to prevent the loss of plants and grass by means of uncontrolled growth, diseases, insects, absence of nutrients, extreme climatic conditions and others.	Consultant/ contractor

Table 6-4: Summary of proposed mitigation measures for off-grid solar PV power generation plants

Impact	*Mitigation Measures*	*Responsibility*
CONSTRUCTION & OPERATION OF A SOLAR PV POWER PLANT		
Fauna and Flora	❑ Siting to avoid critical terrestrial and aquatic critical habitat. ❑ Designing and constructing wildlife access to avoid or minimize habitat fragmentation. ❑ Avoiding or modifying construction activities during breeding or other sensitive seasons. ❑ Minimizing removal of native plant species and replanting of native plant species in disturbed areas.	Consultant/ contractor Operator/ RREA
Solid Waste	❑ Consider ultimate disposal options at the start of the project and devise plans. ❑ When purchasing solar PV cells, opt for solar modules manufacturers who provide recycling of the panels with the purchase. ❑ Regarding cadmium contamination, all microprocessors should be recovered and adequately disposed of as hazardous waste upon decommissioning.	Consultant/ contractor Operator/ RREA
Socio-economics	❑ Land should be acquired on a voluntary basis with current landowners and tenants and prices should be negotiated with current owners at market rates. ❑ For projects that involve involuntary physical or economic displacement, land must be acquired in accordance with IFC's Performance Standard 5 (Land Acquisition and Involuntary Resettlement) and, where indigenous peoples are involved. ❑ The resettlement, compensation and community consultation processes, and agreements must be clearly documented. ❑ Land use patterns should be assessed to determine if there are current existing land uses, such as agriculture or tourism that could be diminished as a result of the establishment of a solar PV project.	Consultant/ contractor
Physical cultural resources	❑ Conduct appropriate project siting at the planning stage to avoid physical cultural resources and touristic sites ❑ Adopt, 'Archaeological Chance Find Procedures' particularly where excavation works will take place (Appendix F)	Consultant/ contractor
Visual intrusion	❑ Consideration of the landscape character during siting ❑ Evaluation of visual impacts from relevant viewing angles. ❑ Ancillary structures such as fencing and on-site roads should be minimized, steep slopes avoided, erosion control measures, and revegetation procedures implemented.	Consultant/ contractor

Table 6-5: Summary of proposed mitigation measures for power transmission and distribution.

Impact	*Mitigation Measures*	*Responsibility*
	POWER TRANSMISSION AND DISTRIBUTION	
Land resources	❑ Select the ROW to avoid important social, agricultural, and cultural resources; ❑ Route ROWs away from wild lands; ❑ Provide access control; ❑ Utilize alternative tower designs to reduce ROW width requirements and minimize land use impacts; ❑ Adjust the length of the span to avoid site-specific tower pad impacts; ❑ Manage resettlement in accordance with World Bank procedures.	Consultant/ Contractor
Noise	❑ Locate ROWs away from human receptors, to the extent possible ❑ Use noise barriers or noise canceling acoustic devices	Consultant/ Contractor
Fauna and flora	❑ Selecting transmission and distribution rights-of-way, access roads, lines, towers, and substations to avoid critical habitat through use of existing utility and transport corridors, whenever possible ❑ Installing transmission lines above existing vegetation to avoid land clearing ❑ Avoiding construction activities during the breeding season and other sensitive seasons or times of day ❑ Re-vegetating disturbed areas with native plant species ❑ Removing invasive plant species during routine vegetation maintenance ❑ Regular maintenance of vegetation within the rights-of-way to avoid disruption to overhead power lines and towers ❑ Removing invasive plant species, whenever possible, and cultivating native plant species ❑ Avoiding clearing in riparian areas ❑ Avoiding use of machinery in the vicinity of watercourses ❑ Manage herbicide application to avoid their migration into off-site land or water environments ❑ Monitoring right-of-way vegetation according to fire risk ❑ Removing blowdown and other high-hazard fuel accumulations ❑ Time thinning, slashing, and other maintenance activities to avoid forest fire seasons ❑ Disposal of maintenance slash by truck or controlled burning ❑ Planting and managing fire resistant species, such as hardwoods, within, and adjacent to, rights-of-way ❑ Establishing a network of fuel breaks of less flammable materials or cleared land to slow progress of fires and allow fire fighting access ❑ Aligning transmission corridors to avoid critical avian habitats (e.g. nesting grounds, heronries, rookeries, bat foraging corridors, and migration corridors) ❑ Maintaining 1.5 meter spacing between energized components	Consultant/ contractor

Impact	*Mitigation Measures*	*Responsibility*
	and grounded hardware or, where spacing is not feasible, covering energized parts and hardware ❑ Retrofitting existing transmission or distribution systems by installing elevated perches, insulating jumper loops, placing obstructive perch deterrents (e.g. insulated "V's"), changing the location of conductors, and / or using raptor hoods ❑ Considering the installation of underground transmission and distribution lines in sensitive areas ❑ Installing visibility enhancement objects such as marker balls, bird deterrents, or diverters	
Community health and safety	❑ Utilizing mechanical clearing techniques, grazing and/or selective chemical applications ❑ Selecting herbicides with minimal undesired effects ❑ Not applying herbicides with broadcast aerial spraying ❑ Maintaining natural low-growing vegetation along the ROW ❑ Use of signs, barriers (e.g. locks on doors, use of gates, use of steel posts surrounding transmission towers, particularly in urban areas), and education / public outreach to prevent public contact with potentially dangerous equipment ❑ Grounding conducting objects (e.g. fences or other metallic structures) installed near power lines, to prevent shock ❑ Considering siting new facilities so as to avoid or minimize EMF exposure to the public ❑ Installation of transmission lines or other high voltage equipment above or adjacent to residential properties or other locations intended for highly frequent human occupancy, (e.g. schools or offices), should be avoided ❑ Evaluating potential exposure to the public against the reference levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) ❑ Application of engineering techniques to reduce the EMF produced by power lines, substations, or transformers	Consultant/ contractor
Occupational health and safety	❑ Only allowing trained and certified workers to install, maintain, or repair electrical equipment ❑ Deactivating and properly grounding live power distribution lines before work is performed on, or in close proximity, to the lines ❑ Ensuring that live-wire work is conducted by trained workers with strict adherence to specific safety and insulation standards; ❑ Where maintenance and operation is required within minimum setback distances, defining specific training, safety measures, personal safety devices, and other precautions in a health and safety plan ❑ When working at elevations, testing structures for integrity prior to undertaking work; ❑ Implementation of a fall protection program that includes training in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment; and rescue of fall-arrested workers;	Consultant/ contractor

Impact	*Mitigation Measures*	*Responsibility*
	❑ Establishment of criteria for use of 100 percent fall protection ❑ Provision of an adequate work-positioning device system for workers. Connectors on positioning systems should be compatible with the tower components to which they are attached; ❑ Properly rate and maintain hoisting equipment and properly train hoist operators; ❑ Ensure that safety belts are not less than 16 mm two-in-one nylon or material of equivalent strength. Replace rope safety belts before signs of aging or fraying of fibers become evident; ❑ When operating power tools at height, use a second (backup) safety strap; ❑ Remove signs and other obstructions from poles or structures prior to undertaking work; ❑ Identify potential exposure levels to electric and magnetic fields (EMF) in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities; ❑ Train workers in the identification of occupational EMF levels and hazards; ❑ Establish and identify safety zones where EMF levels are acceptable for public exposure; ❑ Implement action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels (limiting exposure time through work rotation, increasing the distance between the source and the worker, or the use of shielding material) ❑ Train personnel to apply pesticides and ensure that personnel have received the necessary certifications or equivalent training where such certifications are not required; ❑ Respect post-treatment intervals to avoid operator exposure during reentry to crops with residues of pesticides; ❑ Ensure hygiene practices are followed to avoid exposure of family members to pesticides residues.	
Airline traffic	❑ Avoid the siting of transmission lines and towers close to airports and outside of known flight path envelopes ❑ Consult with regulatory air traffic authorities prior to installation; ❑ Adhere to regional or national air traffic safety regulations; ❑ Use buried lines when installation is required in flight sensitive areas	Consultant/ contractor
Socio-economics	❑ Extensive public consultation during the planning of powerline and power line right-of-way locations; ❑ Accurate assessment of changes in property values due to power line proximity; ❑ Siting power lines, and designing substations, with due consideration to landscape views and important environmental and community features; ❑ Location of high-voltage transmission and distribution lines in less populated areas, where possible;	Consultant/ contractor

Impact	*Mitigation Measures*	*Responsibility*
	❑ Burying transmission or distribution lines when power must be transported through dense residential or commercial areas.	
Physical cultural resources	❑ Proper siting of a hydropower plant to avoid loss of historic and cultural properties ❑ Adopt, 'Archaeological Chance Find Procedures' particularly where excavation works will take place (Appendix F)	Consultant/ contractor

6.2 MONITORING

Impact and compliance monitoring should be practiced during the construction and operation phases of the project. Monitoring should be conducted to verify the predicted impacts, examine the implementation and effectiveness of mitigation measures, respond to unanticipated environmental impacts, and improve environmental controls. Monitoring should be conducted by trained individuals following monitoring and record-keeping procedures and using properly calibrated and maintained equipment. Monitoring data should be analyzed and reviewed at regular intervals and compared with the operating standards so that any necessary corrective actions can be taken. Note that the scale/nature of the project dictates that the level of the proposed monitoring plan, whereby small projects favor monitoring that is limited to visual observations and photographic documentation while large scale projects require quantitative assessment of several environmental parameters in addition to visual monitoring. Table 6-6 to Table 6-10 present typical parameters that should be monitored along with monitoring means, frequency, and phase. The RREA, or an independent consultant hired by the RREA, will be responsible for the implementation of the monitoring. It should be stressed that the developed monitoring plan should be updated to reflect the specificities of each project (scale, location, etc.) and should also incorporate an estimate of the total monitoring costs involved.

Table 6-6: Summary of monitoring activities during general construction and/or rehabilitation activities

Parameter	*Location*	*Monitoring means*	*Frequency*	*Phase*
GENERAL CONSTRUCTION AND/OR REHABILITATION ACTIVITIES				
Air quality	Construction site	Inspection and measurement of PM level upon complaints	NA	Construction
Noise levels	Construction site	Inspection and measurement of noise level upon complaints	NA	Construction
Wastes and disposal	Construction site Disposal site	Visual inspection and photographic documentation	Monthly	Construction
Surface water	At nearby surface water body	Visual inspection	Monthly	Construction
Soil and groundwater	At construction site	Visual inspection	Monthly	Construction
Flora and fauna	Project site and surrounding areas	Presence of key species	Before project execution	Construction
Traffic	Construction site and nearby road network	Inspection	Upon complaints	Construction
Health and safety	Project site	Visual inspection and photographic documentation	Monthly	Construction
Socio-economic	Project site and surrounding areas	Jobs created for local people	Biannually	Construction
Landscape and visual intrusions	At site boundaries	Visual inspection and photographic documentation	Monthly	Construction
Physical cultural resources	All vulnerable sites adjacent to project and all unknown remains unearthed during construction	Disturbance of known sites Document chance findings	Annually	Construction

Table 6-7: Summary of monitoring activities during operation of a mini-hydropower station

Parameter	*Location*	*Monitoring means*	*Frequency*	*Phase*
OPERATION OF A MINI-HYDRO POWER PLANT				
Air and noise quality	At the plant site At sensitive receptors	Inspection and measurement of noise level (Leq)	Quarterly Upon complaint	Operation
Traffic	Construction site and nearby road network	Inspection	Upon complaints	Construction
Surface water (quality and quantity)	At reservoir/ or Downstream of diversion	Water depth Water quality (total coliforms, dissolved oxygen, phosphates and/or nitrates)	Biannually	Operation
Soil quality	Agricultural lands surrounding project	Inspection	Biannually	Operation
Biological environment (terrestrial and aquatic)	Project site and surrounding areas	Downstream flow measurement Presence of key species	Biannually Annually	Operation
Landscape and visual intrusion	At site boundaries	Visual inspection and photographic documentation The sustainability of landscape planting	Monthly Annually	Operation
Health and safety	Project site Project site Project site and surrounding areas	Visual inspection and photographic documentation Inspection and drilling emergency response plan Surveys of disease outbreaks related to water vectors	Monthly Annually Annual	Operation
Socio-economics	Project site and surrounding areas	The effectiveness of acquisition procedure and of compensation disbursement	Continuous	Construction & Operation

Table 6-8: Summary of monitoring activities during operation of a diesel-fuel power plant

Parameter	*Location*	*Monitoring means*	*Frequency*	*Phase*
OPERATION OF A DIESEL-FUEL POWER PLANT				
Air quality	Plant site and selected sensitive receptors	Inspection and measurement of ground level PM, NOx, CO, and SO_2 concentrations	Quarterly	Operation
Noise levels	Plant site and selected receptors	Inspection and measurement of noise level upon complaints	NA	Operation
Wastes and disposal	Plant site Disposal site	Visual inspection and photographic documentation	Monthly	Operation
Surface water quality	Samples from surface water body at the point of effluent discharge and at several locations downstream from the effluent discharge	pH, Temperature, TSS, Oil and grease, Total residual chlorine, Heavy metals,	Quarterly	Operation
Groundwater	Well used to extract water for cooling	Pump test	Monthly	Operation
Spills and leakages	At fuel storage and transfer sites	Visual inspection and photographic documentation Inspection and drilling on oil spill response plan	Continuous Annually	Operation
Health and safety	Project site	Visual inspection and photographic documentation	Monthly	Operation
Socio-economic	Project site and surrounding areas	Jobs created for local people	Biannually	Construction
Landscape and visual intrusions	At site boundaries	Visual inspection and photographic documentation	Monthly	Operation

Table 6-9: Summary of monitoring activities for off-grid solar PV power generation plants

Parameter	*Location*	*Monitoring means*	*Frequency*	*Phase*
INSTALLATION AND OPERATION OF PV POWER PLANTS				
Fauna and Flora	Project site and surrounding areas	Occurrence of key species at start of the project and initiate annual follow-up	Before project execution and annual follow-up	Installation Operation
Wastes and disposal	Plant site Disposal site	Visual inspection and photographic documentation	Monthly	Operation Decommissioning
Socio-economics	Project site and surrounding areas	Jobs created for local people	Biannually	Construction
Physical cultural resources	All vulnerable sites adjacent to project and all unknown remains unearthed during construction	Disturbance of known sites Document chance findings	Annually	Installation
Visual Intrusion	At site boundaries	Visual inspection and photographic documentation The sustainability of landscape planting	Monthly	Operation

Table 6-10: Summary of monitoring activities for power transmission and distribution activities

Parameter	*Location*	*Monitoring means*	*Frequency*	*Phase*
POWER TRANSMISSION AND DISTRIBUTION				
Land resources	Along the constructed line	Visual inspection	As the line is being constructed	Construction
			Annually	Operation
Noise levels	Constructed line	Inspection and measurement of noise level upon complaints	NA	Operation
Fauna and flora	Project site and surrounding areas	Presence of key species	Before project execution and annual follow-up	Construction Operation
Surface water	Nearby surface water bodies	Water quality (Herbicide residues)		Operation[1]
Community health and safety	Project site and surrounding areas	Visual inspection and photographic documentation	Biannually	Operation
Occupational health and safety	Project site	Visual inspection and photographic documentation	Continuous	Construction Operation
Socio-economic	Project site and surrounding areas	Jobs created for local people	Biannually	Construction Operation

[1] If herbicides are being used for ROW clearing

7 SUB-PROJECT SCREENING, REVIEW AND APPROVAL

This section outlines the screening, review, and approval process for activities to be financed under the SREP project in Liberia. As the locations for the subprojects are not clearly identified at this stage, it is important to have the appropriate tools in place to assist the SREP implementing agency (RREA) in screening these activities for potential impacts and to provide guidelines for implementing measures to effectively address them.

In addition, the following section provides a "harmonized" approach to the screening and appraisal process for sub-projects. Once the sub-projects have been identified and locations selected, the RREA ESMT should use this section as the guideline to screening sub-projects and implementing the appropriate measures while ensuring adherence to all respective legislative requirements for screening and ESIAs.

7.1 IMPLEMENTING PARTY

The Rural and Renewable Energy Agency (RREA) will be the party to implement the ESMF through its Environmental and Social Management Team (ESMT), as described in Chapter 9.

Figure 7-1 illustrates the process for screening, review and appraisal process of subprojects.

7.2 SCREENING AND REVIEW PROCESS

7.2.1 Screening of Sub-Project Activities

Once the sub-project activity is defined and the location selected, a screening form will need to be filled out by the RREA ESMT. The form will allow for identification of the potential environmental and social impacts associated with the proposed activity. As the ESMF and RPF should be utilized in tandem, the screening form will also allow for the identification and assessment of impacts related to potential land acquisition and involuntary resettlement. The screening form together with the process by which it applies is shown in Appendix F.

The screening will be undertaken using information gathered from a site reconnaissance (field appraisal) as well as from existing data sources (professional expertise; in some cases,

interviews with local people could provide information regarding human use values and/or environmental significance), and will be used not only initially to improve the developing project, but subsequently to ensure that the environmental and social impacts are properly identified and appropriate mitigation measures are incorporated into the projects.

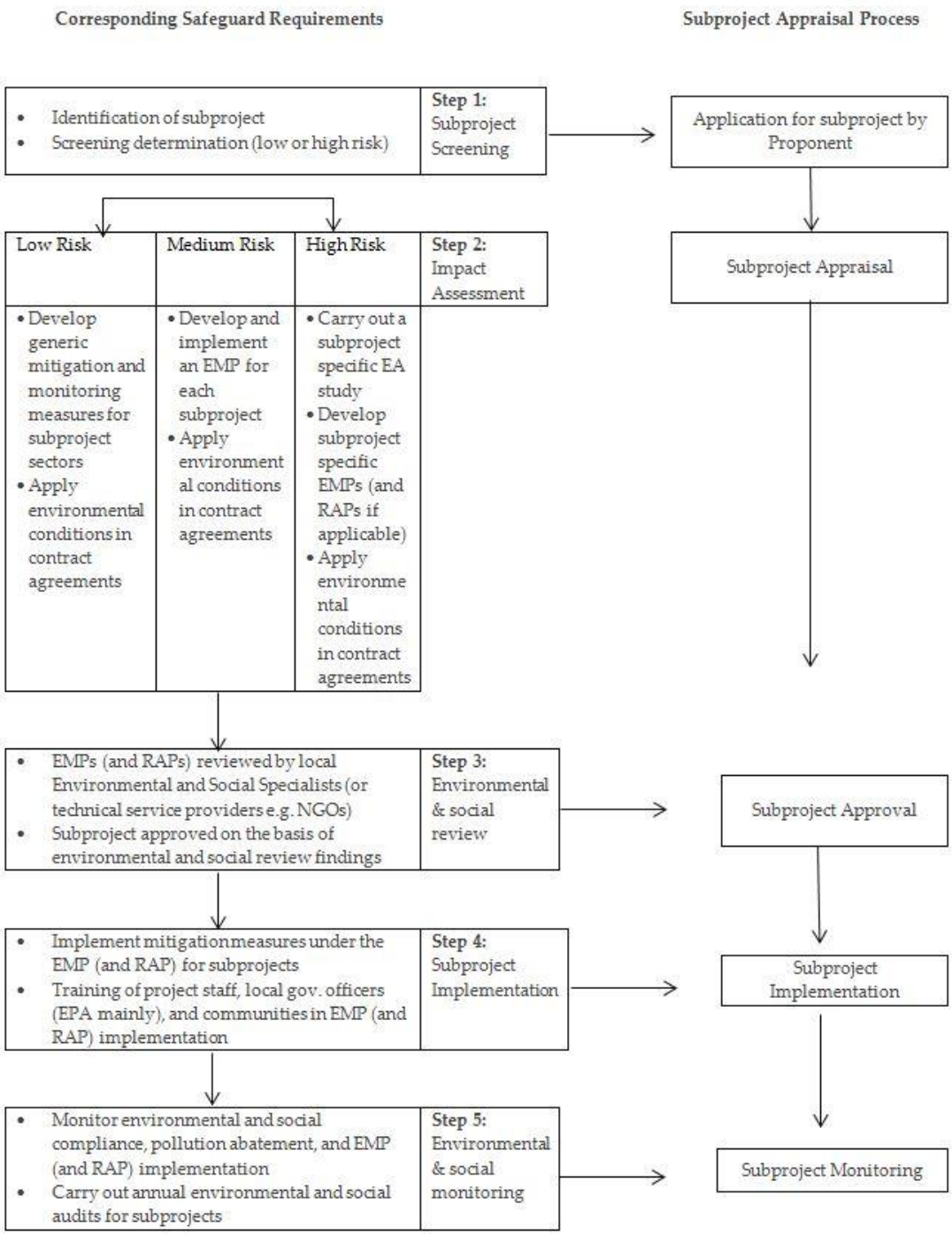


Figure 7-1: Proposed Screening, Review and Appraisal Process.

As part of the field appraisal, RREA (the Proponent) shall identify the major

stakeholders/community groups within the affected area that are likely to be affected. A list of potentially affected groups will be compiled and appended to the appraisal report.

From current knowledge of the receptors in the area and the small impacts that are predicted from the scale of the SREP proposals, the World Bank safeguards category for the project is 'B', as the types of interventions foreseen would not have major impacts on the population or environment.

In the event that significant adverse environmental impacts that are sensitive, diverse or unprecedented be predicted during the screening stage are identified during screening, RREA will consult with the World Bank before proceeding further.

7.2.2 Assessment and Classification of Impacts

Based on the screening findings (when required), the impacts are classified based on their risk category and a decision is made as to whether the sub-project will:

- Require an ESIA study and/or Resettlement Action Plan/ Livelihood Restoration Plan, since the impacts qualify as being high-risk and significant and may result in land acquisition and/or involuntary resettlement;
- Require only an ESMP, since the impacts are not significant and can be easily addressed through the implementation of a mitigation and management plan during construction and operation of the sub-project; or
- Not require any specific safeguard measures, as the impacts are considered minimal and readily mitigated through the application of the generic EHS clauses (such as those specified in Appendix D for application to all works contracts).

7.2.3 Identifying Alternatives to Sub-Project Design

For sub-projects deemed high risk, as they may result in significant impacts, RREA (the Proponent) will reassess the location and design of the sub-project to ensure that there are no alternatives that might minimize or avoid these potential environmental and social impacts. If an alternative is not feasible, then the Proponent will prepare an ESIA and/or Resettlement Action Plan/ Livelihood Restoration Plan to identify the appropriate and necessary mitigation measures for an acceptable project.

7.3 APPRAISAL AND MONITORING PROCESS

7.3.1 Appraisal and Approval

For High Risk sub-projects requiring an ESIA:

RREA will notify and consult with the World Bank on the need to prepare an ESIA. ESIA will be prepared in accordance to the World Bank standards as well as the Environmental Protection Agency guidelines; ESIA must be approved by the EPAL prior to proceeding with the implementation of sub-projects. It should include all relevant information (as outlined in the country's legislative requirements – refer to Chapter 2): an ESMP, a set of environmental contract clauses, and a summary of public consultations carried out.

Appendix C provides the Terms of Reference for preparation of an ESIA.

For sub-projects that may result in involuntary resettlement or displacement, RREA is also required to submit a Resettlement Action Plan/ Livelihood Restoration Plan to the EPAL and World Bank for approval. This is explained in more detail in the Project's Resettlement Policy Framework.

For Medium Risk sub-projects that require an ESMP:

RREA will submit a copy of the Simplified ESIA (usually in the form of an ESMP) to the EPAL. The objective of the ESMP is to cater to the environmental and social needs of the project in a simple, responsive, and cost-effective manner that will not unnecessarily overload or impede the project cycle. The ESMP should outline the measures needed to address the issues identified during the EA study. Moreover, a good ESMP should demonstrate that proposed monitoring activities will encompass all major impacts and identify how they will be integrated into project supervision.

The ESMP should be a simple document that outlines the following:

- Main environmental and social mitigation measures;
- Environmental training and capacity program; and
- Environmental and social monitoring program.

Contents of an ESMP:

- Potential environmental and social impacts related to siting, construction, and operation of the sub-project;
- Mitigation and monitoring measures to address potential impacts;
- Responsibilities for monitoring ESMP requirements;
- Training and capacity-building requirements for project officers and communities; and
- Estimated budget for implementation and training.

Chapter 8 provides detailed guidance on the implementation of ESMPs under the SREP.

RREA is required to include environmental contract clauses in the technical specifications and account for these measures in the sub-project implementation budget. Appendix D provides a set of recommended contract clauses to include in contractor agreements. These EHS contract clauses would also be used in the preparation of contract documents for low risk projects.

7.3.2 Criteria for Approval

- For those ESIAs that meet the country's ESIA requirements and World Bank OP 4.01, an environmental permit can be granted.
- For those ESIAs that do not meet the country's ESIA requirements and World Bank OP 4.01, an environmental permit is rejected and the EPAL may choose to carry out an audit. RREA will be asked to re-submit the ESIA based on recommendations of the audit.
- As emphasized in the World Bank's guidelines, a sub-project should not be approved and funded until such reports are received, approved, and disclosed.

7.3.3 Disclosure of Sub-Project Information

In compliance with World Bank guidelines and ESIA law in Liberia, before a sub-project is approved, the applicable documents (ESIA, ESMP, and/or Resettlement Action Plan/ Livelihood Restoration Plan) must be made available for public review at a place accessible

to local people (e.g., at EPAL's district county office, EPAL headquarters and Proponents offices) in a form, manner, and language they can understand.

7.3.4 Annual Monitoring Reports

Once implementation of the sub-project has started, regular supervisory missions should be carried out by RREA's ESMT (by the Environmental Specialist or contracted out to a Consultant) and an annual monitoring report submitted to the EPAL and to the World Bank for review.

8 ACTION PLAN FOR IMPLEMENTATION OF ESMP

As it is more likely that SREP investments will result in the need for ESMPs (with targeted EA) and not ESIAs, since impacts are expected to site specific and capable of mitigation and therefore Category B at most, the following section provides more detailed guidelines for preparation and implementation of ESMPs.

8.1 IMPLEMENTATION GUIDELINES FOR AN ESMP

As discussed, any projects classified as Category B will require an ESMP to be approved and disclosed prior to sub-project implementation. A Terms of Reference for preparation of the ESMP is provided in Appendix C. It is important to keep in mind that the content of the ESMP will depend strongly on the nature of risk associated with the sub-project being proposed.

8.1.1 Institutional/Third Party Roles and Responsibilities

The ESMP should be prepared by RREA, either through an EPA-certified Environmental Evaluator with sufficient knowledge of the environmental and social issues related to the energy sector. Ideally, the consultant should have a strong understanding of the legislative structure of Liberia where the sub-project ESMP will be prepared.

8.1.2 Budget

The ESMP for each sub-project will outline the appropriate budget required to implement measures for mitigation and monitoring. It will also indicate the costs of required training and capacity building (see Section 8.1.43 below).

Prior to the award of works contracts RREA will ensure that there is an adequate financial allowance to deliver the mitigation, based on the outline budget in the ESMP. Examples of the costs to be included in the works contracts are:

- Costs of ensuring the appropriate dust suppression mechanisms are in place during excavation works must be calculated and included in the tender documents;
- Costs of installing erosion control measures should be estimated (usually as part of the engineering costs);

- Training of staff on environmental and OHS issues during construction and operation (for example see Table 8-1); and
- Costs of monitoring noise during construction to confirm regulations are being met.

8.1.3 Capacity Building and Technical Assistance Requirements

As part of best practice, and to comply with international standards for OHS, contractors and supervision consultants will be provided with awareness raising, environmental, and OHS training on site. These will focus on both the construction and operational phases of the Project. A proposed format for a two-day training workshop is provided in the following Table 8-1.

Table 8-1 Awareness raising and training for civil work contractors and supervision consultants

Topic	*Input*
Awareness raising Environmental awareness and the importance of effective mitigation Mitigation measures and environmentally sound construction techniques Compliance with international standards (based on Chapter 6) on OHS for the energy sector Compliance with local legislation on OHS, ESIA, and ESMP requirements	1 day
Technical training Implementation of the ESMP (contract clauses) Monitoring of ESMPs (and RAPs) Preparation of budgets	1 day
Total	2 days

9 CAPACITY BUILDING RECOMMENDATIONS

In order for the Environmental and Social Management Framework (ESMF) to be effectively implemented, the presence of proper environmental management at the national level is helpful. Historically, environmental management in many developing countries has not been accorded the attention its evident importance merits, leading to high costs in terms of adverse impacts on human health, productive resources, and ecosystems.

Although environmental regulations have been evolving in Liberia, the main problems that remain are that of monitoring and enforcement, which are in turn related to the country's institutional and technical capacity for environmental management.

The main institution with key responsibilities for environmental and social management under the SREP is RREA. During consultation with RREA, it was established that the agency has no environmental and social management mechanism, although it relies on some of its staff for social and gender issues. It should be noted that the agency lacks experts in the environmental field.

The agency **will** establish an environmental and social management team (ESMT).

This team will be responsible for overseeing at least the following:

- Screening of projects
- Categorizing projects as per the World Bank, other financing agencies, EPAL and other national regulating authorities.
- Drafting the Terms of References for ESIAs, ESMPs, and RAPs/ Livelihood Restoration Plan.
- Procuring and supervising service providers.
- Implementation of ESIAs, ESMPs, and RAPs/ Livelihood Restoration Plan.
- Environmental and social monitoring, as well as internal audits.

Capacity building is an essential component towards sustainable environmental management. Establishment and operation of the ESMT at the RREA is a key. The RREA's ESMT should consist of at least 3 key staff positions. The ESMT should report to the RREA

director responsible for project implementation and the delivery of the SREP. The three key staff positions are:

- The environmental expert
- The social expert
- The community liaison officer

For each position, an appropriately qualified person will be proposed and a CV for each person clearly showing the skills, experience and qualifications/training that makes them suitable for the role will be submitted for the agreement of the World Bank.

9.1 INSTITUTIONAL STRENGTHENING & CAPACITY BUILDING

Once established, the ESMT needs to have adequate training as well as suitable equipment in order to fulfill its functions.

The objective of the training and capacity building program is to ensure appropriate environmental awareness, knowledge and skills for the implementation of environmental management plans as well as environmental and process monitoring. In addition to the ESMT staff, training sessions will be opened for other individuals from the RREA and other concerned ministries and governmental authorities.

The typical scope of the training sessions will encompass:

- Defining relevant environmental laws, regulations, and standards
- Reviewing and discussing the World Bank's Safeguard Policies.
- Conducting bid tenders where appropriate while ensuring that the World Bank's Safeguard Policies, the applicable EPA legislations and GoL laws are respected.
- Reviewing Environmental Impact Assessment methodology (at both the sub project and strategic levels) and environmental sampling and monitoring procedures (air, noise, water, etc.).

- Introducing mitigation measures aimed at minimizing adverse environmental impacts associated with the construction and operation of energy-related projects with special emphasis on low technology, affordable and sustainable measures.
- Introducing the fundamentals of occupational health and safety procedures with emphasis on the risks associated with electricity production.
- Presenting case study EMPs of relevant projects (hydroelectric projects, thermoelectric projects, solar power energy production (such as thermal power generation, hydroelectric power generation, solar power generation, etc.))
- Conducting an open dialogue with the targeted audience, whereby individuals will be asked to share their experiences (success stories and shortcomings) in implementing ESMPs and the main technical problems faced in the field.

The training program will be discussed and agreed with the World Bank and is to consist of technical assistance, likely by individual consultants, and will be targeted at RREA's ESMT individuals. It is proposed that the training program be implemented at least once a year over a period of two years—roughly the period of the two current Bank projects. Staff and operators of sub-projects may also be targeted as appropriate.

A budget estimate for the required capacity building at RREA is given in Table 9-1 below. The Total Budget is estimated at around US$680,000 (Table 9-1). This is only an indicative budget, and the final budget will be agreed with the World Bank alongside the details of the content and delivery of the training.

Table 9-1: Estimated budget for capacity building at RREA

Description	*Cost (USD)*
Establishment of the RREA's ESMT	**20,000.00**
Training of the RREA's ESMT	**150,000.00**
Equipping the RREA's ESMT	**150,000.00**
Running the RREA's ESMT*	**360,000.00***
Total Budget For ESMT	***680,000.00***

*The budget is set to run the ESMT for 5 years-term, the term required for the unit to be integrated in the government system. This budget also includes the ESMT implementing its duties such as consultations with stakeholders.

9.2 DEVELOPMENT OF ENVIRONMENTAL POLICY

It is necessary for RREA to clearly define its environmental policy and strategy. This activity should be driven by the ESMT in RREA and the resultant policy should be approved by the RREA Board. Development of an environmental and social policy should not be a difficult task given that there are numerous examples from other countries, which could be used as a point of departure for developing a policy for RREA. Following this it will be possible to establish an environmental management system.

9.3 BUDGETING FUTURE SAFEGUARDS MEASURES

The above budget refers only to the safeguards training program proposed for the RREA's ESMU unit. The cost of undertaking the safeguards related studies (including update of this ESMF, undertaking EIA, specific environmental studies, preparing contract clauses, monitoring and evaluating delivery of mitigation etc) will be financed by RREA. The cost for delivery of the mitigation measures will be included within the works contractors for the construction/operation activity. The bidding documents of the contractor will be reviewed by RREA EMST to ensure that the recommendations set forth herein are reflected and their implementation adequately included in the overall price of the works.

10 PUBLIC PARTICIPATION

Public involvement and consultations are important components in projects related to the energy and electricity sectors in order to ensure information is properly conveyed and that cooperation and acceptance from the public is secured. For the SREP project, public participation will be undertaken with the aim of increasing general environmental awareness among the public and various stakeholders in regards to the proposed project and to identify and address their concerns. The SREP project:

- regards public participation as proper and fair part of the decision-making activities.
- accepts public participation as a way to ensure that projects meet the stakeholders' needs and are suitable to the affected public.

The effectiveness of public participation is measured by the degree of communication, the intensity of contact and the degree of influence for decision making.

Table 10-1 represents some example of effective public participation techniques that will be used during the project development phases.

Table 10-1: Examples of effective public participation techniques.

Technique	*Objective(s)*	*Scope*	*Participants*
Public Displays	• To inform about the project	• Informative	Affected people and other relevant interests
Public Meetings	• To identify issues and to solicit feedback	• Consultative	Affected people consisting of village officials, informal leaders and local people
Focus Group / Discussion	• To identify issues and to solicit feedback • To get ideas for environmental management	• Informative • Consultative • Environmental Management	Affected people

10.1 REGULATIONS AND REQUIREMENTS

According to Sections 17 and 18 of the Environmental Protection and Management Law and World Bank safeguard policies for involuntary resettlement, indigenous peoples and environmental assessment, public consultations are an integral component of the ESIA, RAP and IPP requirements and the guidelines identify the following principal elements:

- Developers are required to conduct public consultation during the preparation of ESlAs.
- Formal ESIA document is made available for public review and comments. Documents to which the public has access include Project Briefs, ESIA terms of reference, draft and final ESIA reports, and decisions of the appropriate authorities regarding project approval.

Consultations should identify key issues and determine how the concerns of all parties will be addressed in response to the terms of reference for the ESIA. The public will be allowed to access information in Liberia (EPA) before project appraisal and in World Bank INFO-Shop before project appraisal in English. This is in fulfillment of WB Disclosure Policy (BP 17.50).

10.2 PROCESS FOR PUBLIC CONSULTATION IN THE ESMF

During the course of the Project, consultations will be carried out with all significant stakeholder groups (Table 10-2).

Table 10-2: Key Stakeholder Groups

Key Stakeholder Groups	
Government and regulatory agencies	EPA, Ministry of Lands Mines & Energy, Rural & Renewable Energy Agency, Ministry of Public Works.
Public and private sector operators	Liberia Electricity Corporation (LEC), Liberia Water & Sewer Corporation (LWSC), Liberia Petroleum Refining Company (LPRC)
Non-government organizations	International and local stakeholder groups, including environmental NGOs.
Local stakeholders	Community-based organizations (CBOs), district-level committees, unions, and other local groups.
Academic and research institutions	Environmental research groups, universities, and technical institutes.
Indigenous communities	If projects are planned to be performed in an indigenous people's territory.

For sub-projects that will be developed in indigenous territories, a translator will be used so that the entire audience can be informed about the project. Concerns and suggestions will be considered during the project development phases and during the environmental and social evaluation so that they can be considered in the final evaluation. These consultations will be the responsibility of the RREA ESMT.

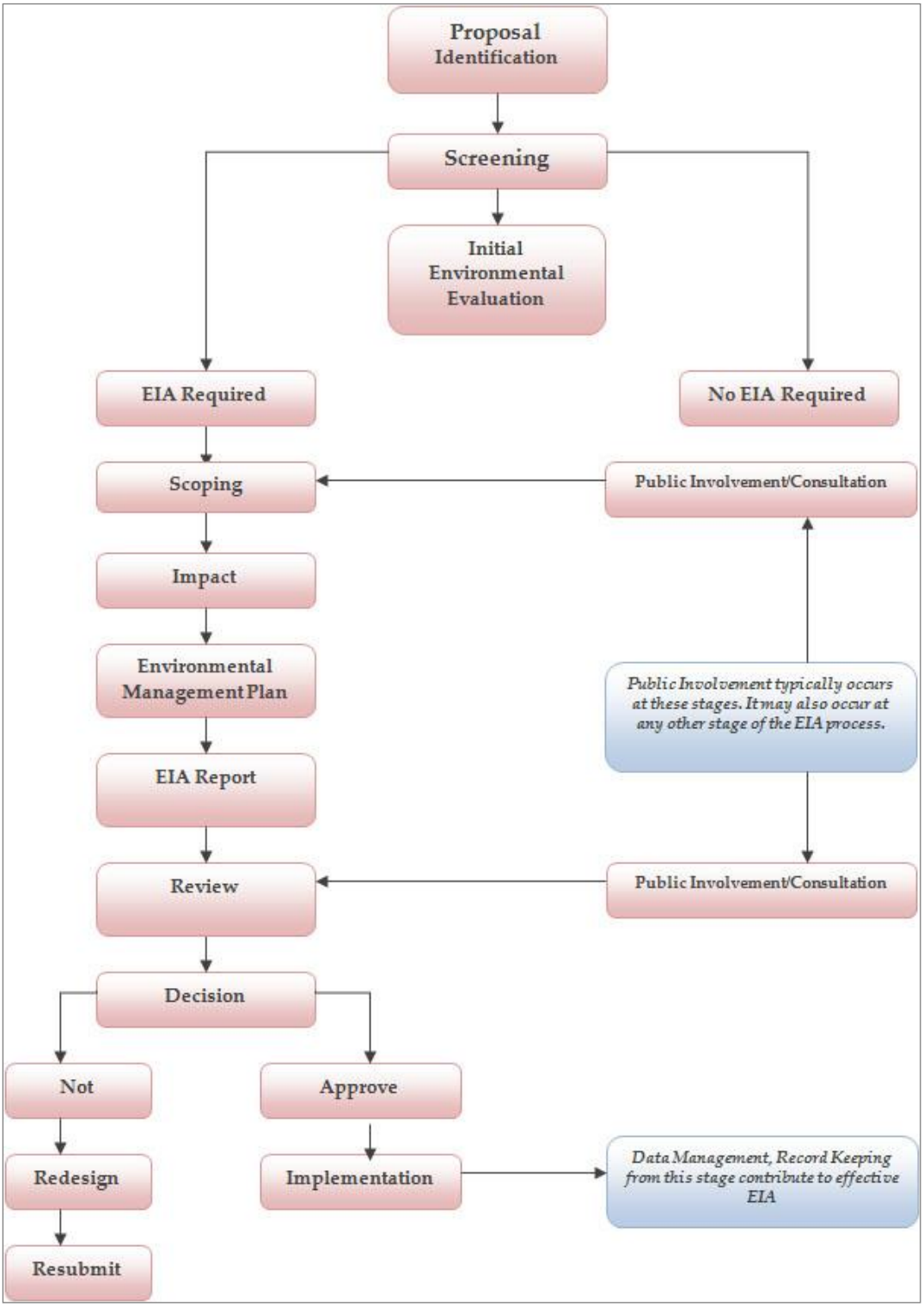
Initial consultations have been conducted as part of the preparation of this ESMF. The summary of the feedback received can be found in Appendix G.

10.3 PROPOSED DISCLOSURE PLAN

Both the EPA and the World Bank procedures require that an ESIA be prepared and publicly disclosed prior to project appraisal. This allows the public and other stakeholders to comment on the possible environmental and social impacts of the project, and the appraisal team to strengthen the project design as necessary, particularly measures and plans to prevent or mitigate any adverse environmental and social impacts.

Toward this end, this document will be publicly released through the World Bank's Info Shop and in public locations in Liberia (EPA is mostly recommended). The documents should be made available in English in compliance with the World Bank's Public Consultation and Disclosure Policy.

APPENDIX A FLOW CHART OF NATIONAL PROCESS FOR ESIA


Proposal Identification
Screening
Initial Environmental Evaluation
EIA Required
No EIA Required
Scoping
Public Involvement/Consultation
Impact
Environmental Management Plan
Public Involvement typically occurs at these stages. It may also occur at any other stage of the EIA process.
EIA Report
Review
Public Involvement/Consultation
Decision
Not
Approve
Redesign
Implementation
Data Management, Record Keeping from this stage contribute to effective EIA
Resubmit

APPENDIX B SUMMARY OF WORLD BANK'S SAFEGUARD POLICIES

OP 4.01: Environmental Assessment	The objective of this policy is to ensure that Bank-financed projects are environmentally sound and sustainable, and that decision-making is improved through appropriate analysis of actions and of their likely environmental impacts. This policy is triggered if a project is likely to have potential (adverse) environmental risks and impacts on its area of influence. OP 4.01 covers impacts on the natural environment (air, water and land); human health and safety; physical cultural resources; and trans boundary and global environment concerns.	Depending on the project, and nature of impacts a range of instruments can be used: EIA, environmental audit, hazard or risk assessment and environmental management plan (EMP). When a project is likely to have sectoral or regional impacts, sectoral or regional EA is required. The Borrower is responsible for carrying out the EA.
OP 4.04 Natural Habitats	This policy recognizes that the conservation of natural habitats is essential to safeguard their unique biodiversity and to maintain environmental services and products for human society and for long-term sustainable development. The Bank therefore supports the protection, management, and restoration of natural habitats in its project financing, as well as policy dialogue and economic and sector work. The Bank supports, and expects borrowers to apply, a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development. Natural habitats are land and water areas where most of the original native plant and animal species are still present. Natural habitats comprise many types of terrestrial, freshwater, coastal, and marine ecosystems. They include areas lightly modified by human activities, but retaining their ecological functions and most native species.	This policy is triggered by any project (including any sub-project under a sector investment or financial intermediary) with the potential to cause significant conversion (loss) or degradation of natural habitats, whether directly (through construction) or indirectly (through human activities induced by the project). The proposed operation will not fund any activities that would negatively affect natural habitats.
OP 4.12: Involuntary Resettlement	The objective of this policy is to (i) avoid or minimize involuntary resettlement where feasible, exploring all viable alternative project designs; (ii) assist displaced persons in improving their former living standards, income earning capacity, and production levels, or at least in restoring them; (iii) encourage community participation in planning and implementing resettlement; and (iv) provide assistance to affected people regardless of the legality of land tenure.	This policy covers not only physical relocation, but any loss of land or other assets resulting in: (i) relocation or loss of shelter; (ii) loss of assets or access to assets; (iii) loss of income sources or means of livelihood, whether or not the affected people must move to another location. This policy also applies to the involuntary restriction of access to legally designated parks and protected areas resulting in adverse impacts on the livelihoods of the displaced persons. The proposed operation has a RPF which will serve as a guide in preparing RAPs as necessary.
OP 4.37: Safety of Dams	The objectives of this policy are as follows: For new dams, to ensure that experienced and competent professionals design and supervise construction; the borrower adopts and implements dam safety measures for the dam and associated works. For existing dams, to ensure that any dam that can influence the performance of the project is identified, a dam safety assessment is carried out, and necessary	This policy is triggered when the Bank finances: (i) a project involving construction of a large dam (15 m or higher) or a high hazard dam; and (ii) a project which is dependent on an existing dam. For small dams, generic dam safety measures designed by qualified engineers are usually adequate.

	additional dam safety measures and remedial work are implemented.	
OP 7.50: Projects on International Waters	Notification of Riparian Countries The objective of this policy is to ensure that Bank-financed projects affecting international waterways would not affect: (i) relations between the Bank and its borrowers and between states (whether members of the Bank or not); and (ii) the efficient utilization and protection of international waterways. The policy applies to the following types of projects: (a) Hydroelectric, irrigation, flood control, navigation, drainage, water and sewerage, industrial and similar projects that involve the use or potential pollution of international waterways; and (b) Detailed design and engineering studies of projects under (a) above, include those carried out by the Bank as executing agency or in any other capacity.	This policy is triggered if (a) any river, canal, lake or similar body of water that forms a boundary between, or any river or body of surface water that flows through two or more states, whether Bank members or not; (b) any tributary or other body of surface water that is a component of any waterway described under (a); and (c) any bay, gulf strait, or channel bounded by two or more states, or if within one state recognized as a necessary channel of communication between the open sea and other states, and any river flowing into such waters..
OP 4.11: Physical Cultural Resources	The objective of this policy is to assist countries to avoid or mitigate adverse impacts of development projects on physical cultural resources. For purposes of this policy, "physical cultural resources" are defined as movable or immovable objects, sites, structures, groups of structures, natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. Physical cultural resources may be located in urban or rural settings, and may be above ground, underground, or underwater. The cultural interest may be at the local, provincial or national level, or within the international community.	This policy applies to all projects requiring a Category A or B Environmental Assessment under OP 4.01, projects located in, or in the vicinity of, recognized cultural heritage sites, and projects designed to support the management or conservation of physical cultural resources. The proposed operation will not fund any investments that have negative impacts on physical cultural resources.

APPENDIX C TERMS OF REFERENCES FOR ESIA AND ESMP

C.1 TOR FOR ESIA

The TOR evolves from the Scoping process in ESIAs. The critical issues identified during the Scoping exercise, to be carried out in ESIA study, should be included in the TOR. The project proponent should prepare a TOR that both delineates the scope of the ESIA and provides complete guidance for undertaking the ESIA study. After approval from the Environmental Protection Agency (EPA) the TOR becomes an official document. In the ESIA report review process the TOR serves as a standard document against which the subject matter covered by the ESIA report will be evaluated.

The ESIA report should include the following items:

a. *Executive summary:* Concisely discusses significant findings and recommended actions.
b. *Policy, legal, and administrative framework:* Discusses the policy, legal, and administrative framework within which the ESIA is carried out. Explains the EHS requirements of any co-financiers. Identifies relevant international environmental agreements to which the country is a party.
c. *Project description:.* Concisely describes the proposed project and its geographic, ecological, social, and temporal context, including any off-site investments that may be required (e.g., dedicated pipelines, access roads, power plants, water supply, housing, and raw material and product storage facilities). Indicates the need for any resettlement plan. Normally includes a map showing the project site and the project's area of influence.
d. *Baseline data:* Assesses the dimensions of the study area and describes relevant physical, biological, and socioeconomic conditions, including any changes anticipated before the project commences. Also takes into account current and proposed development activities within the project area but not directly connected to the project. Data should be relevant to decisions about project location, design, operation, or mitigatory measures. The section indicates the accuracy, reliability, and source of the data.
e. *Environmental and social impacts:* Predicts and assesses the project's likely positive and negative impacts, in quantitative terms to the greatest extent possible. Identifies

mitigation measures and any residual negative impacts that cannot be mitigated. Explores opportunities for environmental enhancement. Identifies and estimates the extent and quality of available data, key data gaps, and uncertainties associated with predictions, and specifies topics that do not require further attention.

f. *Analysis of alternatives:* Systematically compares feasible alternatives to the proposed project site, technology, design, and operation—including the "without project" situation—in terms of their potential environmental impacts; the feasibility of mitigating these impacts; their capital and recurrent costs; their suitability under local conditions; and their institutional, training, and monitoring requirements. For each of the alternatives, quantifies the environmental impacts to the greatest extent possible and attaches economic values where feasible. States the basis for selecting the particular project design and justifies recommended emissions levels and approaches to pollution prevention and abatement.

g. *Environmental management plan (EMP):* Covers mitigation measures, monitoring, budget requirements, and funding sources for implementation as well as institutional strengthening and capacity building requirements.

h. *Public consultation:* Public consultation will be done in at least two different stages (refer to EPA ESIA flow chart in Appendix A). The first public consultation will be conducted during the scoping process during which the proponent along with the support of an EPA certified Environmental Consultant will present details of the project to the affected public. During the first public consultation, all concerns and views obtained from the stakeholders and the public will be incorporated into the project design such that concerns raised are addressed where appropriate. Results and proposed mitigating measures will then be shared and views obtained with the potentially affected population, NGOs, local authorities and the private sector working in the area where the activity will take place during the second public consultation process. Minutes of all consultations conducted with the various stakeholders and affected communities will form an integral part of the report.

i. *Appendixes*

  i. *List of EA report preparers—individuals and organizations.*

ii. *References—written materials, both published and unpublished, used in study preparation.*

iii. *Record of interagency and consultation meetings, including consultations for obtaining the informed views of the affected people and local nongovernmental organizations (NGOs). The record specifies any means other than consultations (e.g., surveys) that were used to obtain the views of affected groups and local NGOs.*

iv. *Tables presenting the relevant data referred to or summarized in the main text.*

v. *List of associated reports (e.g., socioeconomic baseline survey, resettlement plan)*

C.2 TOR FOR ESMP

The ESMP should be easy to use. References within the plan should be clearly and readily identifiable. Also, the main text of the ESMP needs to be kept as clear and concise as possible, with detailed information relegated to appendices. The ESMP should identify linkages to other relevant plans relating to the project, such as plans dealing with resettlement or indigenous peoples issues.

The following aspects should typically be addressed within ESMPs.

Summary of impacts: The predicted adverse environmental and social impacts for which mitigation is required should be identified and briefly summarized. Cross-referencing to the ESIA report or other documentation is recommended so that additional details can be readily referenced.

Description of mitigation measures: The ESMP identifies feasible and cost-effective measures to reduce potentially significant adverse environmental and social impacts to acceptable levels. Each mitigation measure should be briefly described with reference to the impact to which it relates and the conditions under which it is required (e.g., continuously or in the event of contingencies). These should be accompanied by, or referenced to, designs, equipment descriptions, and operating procedures that elaborate on the technical aspects of implementing the various measures. Where mitigation measures may result in secondary impacts, their significance should be evaluated.

Description of monitoring program: Environmental performance monitoring should be designed to ensure that mitigation measures are implemented and have the intended result, and that remedial measures are undertaken if mitigation measures are inadequate or the impacts were underestimated within the ESIA report. It should also assess compliance with national standards and World Bank Group requirements or guidelines. The monitoring program should clearly indicate the linkages between impacts identified in the ESIA report, indicators to be measured, methods to be used, sampling locations, frequency of measurements, detection limits (where appropriate), and definition of thresholds that will signal the need for corrective actions. Although it is not essential to have complete details of

monitoring in the ESMP, it should describe the means by which final monitoring arrangements will be agreed.

Institutional arrangements: Responsibilities for mitigation and monitoring should be clearly defined. The ESMP should identify arrangements for coordination between the various actors responsible for mitigation.

APPENDIX D EXAMPLE OF ENVIRONMENTAL CONTRACT CLAUSES

The contractor will prepare his own EMP including health and safety at construction site, a traffic management plan, a waste management plan, chance-find procedures for physical cultural resources, etc. The EMP will be approved by the EPA and the World Bank. The contractor is responsible for the implementation of the EMP under the supervision of the RREA ESMT.

As construction activities could cause significant impacts on and nuisances to surrounding areas, careful planning of construction activities is critical. These are generally consistent for all power generation activities due to the similarity of the works involved. The following rules (including specific prohibitions and construction management measures) should be incorporated into all relevant bidding documents, contracts, and work orders.

Note that an extensive, but not exhaustive, list of mitigation measures is provided in Table 6.1 of the report, and should be used as a guideline for the selection of applicable rules and their inclusion in the contractor's contract. More energy-related project-specific rules can be extracted from Tables 6.1 to 6.4.

Prohibitions:

The following activities are prohibited on or near the project site:

(1) Cutting of trees for any reason outside the approved construction area;
(2) Hunting, fishing, wildlife capture, or plant collection;
(3) Use of unapproved toxic materials, including lead-based paints and asbestos;
(4) Disturbance to anything with architectural or historical value;
(5) Building of fires/burning of materials on site;
(6) Use of firearms (except authorized security guards); and
(7) Use of alcohol by workers.

Construction management measures:

Contractors are required to comply with national and municipal regulations governing the environment, public and worker health, and safety. The contractor will undertake the following measures.

Prevent nuisance from dust and other air pollution emissions by:

(1) Dampening surfaces with water, particularly during dry and windy conditions

(2) Installing windbreaks or screens around stores to prevent windblow of materials
(3) Providing a binding surface on haul roads in regular use
(4) Maintaining low traffic speed on-site and on access roads to the site;
(5) Covering all vehicles hauling materials likely to give off excessive dust emissions;
(6) Ensuring adequate maintenance and repair of construction machinery and vehicles;
(7) Cleaning vehicles at entry and exit points to prevent the carryover of dust emissions, beyond the construction site
(8) Maintaining engines in accordance with manufacturers recommendations
(9) Turning off equipment when not in use

Prevent Noise nuisance by:

(1) installing barriers/fencing between the source of noise and sensitive receptors
(2) Effectively utilizing material stockpiles and other structures to reduce noise from on-site construction activities
(3) Using inherently quiet equipment in preference over other more noisy equipment
(4) Operating only well-maintained (in accordance with manufacturers recommendations) equipment on-site
(5) Siting static machinery away from noise sensitive receptors
(6) Ensuring all construction-related traffic operates at low speeds (at or below 15 mph) on streets within 200 m of the site.
(7) Maintaining all on-site vehicle speeds at or below 10 mph.
(8) Ensuring regulatory noise limit values are not exceeded, and ensuring project complies with World Bank guidelines for acceptable noise levels (World Bank, 2007. General EHS Guidelines).
(9) Utilizing and properly maintaining (in accordance with manufacturers recommendations) silencers or mufflers that reduce vibration on construction equipment
(10) Limiting site working hours in noise sensitive areas;
(11) Scheduling noisy activities during the morning hours;
(12) Informing the locals when noisy activities are planned

Minimizing solid waste and avoiding pollution by:

(1) Promoting recycling and reuse of general refuse. Re using generated construction debris materials for reclamation purposes whenever applicable, after ensuring the absence of contamination and the adequacy of the physical and chemical properties of such material;

(2) Minimising construction and demolition wastes through careful planning during the design stage, whereby reducing or eliminating over-ordering of construction materials

(3) Sorting construction and demolition wastes into various categories and adopting re-use/recycle on site whenever deemed feasible.

(4) Segregating chemical wastes and properly storing and disposing of it as hazardous waste.

(5) Storing chemical wastes in a separate area that has an impermeable floor, adequate ventilation and a roof to prevent rainfall from seeping

(6) Clearly labeling all chemical waste in English and Liberian, storing it in corrosion resistant containers and arranging so that incompatible materials are adequately separated

(7) Securing a prior agreement with the EPA for the disposal of hazardous waste generated on-site

(8) Drafting an agreement with the solid waste collector in the county where the project is being implemented to identify collection sites and schedule the removal to minimize odor, pest infestation and litter buildup

(9)

Prevent pollution from wastewater by:

(1) Providing channels, earth bunds or sand bag barriers to properly direct storm water to silt removal facilities such as sand traps, silt traps and sediment basins before discharge into the surrounding waters

(2) Maintaining silt removal facilities by regularly removing deposited silt and grit

(3) Discharging rainwater pumped out from trenches or foundation excavations into storm drains via silt removal facilities and not directly to the aquatic environment

(4) Covering open stockpiles of construction materials on site with tarpaulin or similar fabric during rainstorm events to prevent the washing away of construction materials

(5) Compacting earthworks as soon as the final surfaces are formed to prevent erosion especially during the wet season

(6) Collecting and connecting water used in vehicle and plant servicing areas to foul sewers via an oil/grease trap. Oil leakage or spillage should be contained and cleaned up immediately

(7) Collecting spent oil and lubricants and storing them in appropriate (non polluting) facilities for recycling or proper disposal

(8) Preparing guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel or chemicals.

(9) Containing sewage from toilets, kitchens and similar facilities in sanitary cesspools before being transported by trucks to a nearby wastewater treatment plant

Ensure Health and safety of workers and the local community by:

(1) Restricting access to construction sites, through fencing

(2) Establishing of buffering areas around the site

(3) Providing guards on entrances and exits to the site

(4) Installating of warning signs at the entrance of the site to prohibit public access

(5) Providing training about the fundamentals of occupational health and safety procedures

(6) Providing appropriate personal protective equipment (PPE) (impermeable latex gloves, working overalls, safety boots, safety helmets, hearing protecting devices for workers exposed to noise levels exceeding 90 dBA[1], and lifesaving vests for construction sites near water bodies)

(7) Ensuring that workers can swim and that lifesaving rings are available at the worksite, near water

(8) Ensuring that the protective material is being used wherever it is required

(9) Ensuring that especially sensitive or dangerous areas (like areas exposed to high noise levels, areas for especially hazardous work etc.) are clearly designated

[1] The maximum allowable 8-hour occupational noise standard set by OSHA

(10) Ensuring that all maintenance work necessary for keeping machines and other equipment in a good state will be regularly carried out.

(11) Ensuring that the workers are qualified, well trained and instructed in handling their equipment, including health protection equipment.

(12) Providing adequate loading and off-loading space

(13) Developing and implementing an emergency response plan

(14) Providing on-site medical facility/first aid

(15) Providing appropriate lighting during night-time works

(16) Implementing speed limits for vehicles on site, particularly at entrances/exits

(17) Segregating pedestrians and vehicles on site as far as possible

(18) Ensuring that hazardous substances are being kept in suitable, safe, adequately marked and locked storing places

(19) Ensuring that containers of hazardous substances are clearly marked, and that material safety data sheets are available

(20) Ensuring that all workers dealing with hazardous substances are adequately informed about the risks, trained in handling those materials, and trained in first aid measures to be taken in the case of an accident

(21) Designating an area where contaminated materials and hazardous waste can be stored for proper disposal according to environmental guidelines

(22) The adoption of good housekeeping practices for ensuring hygiene on site

(23) The elimination of pools of stagnant water, which could serve as breeding places for mosquitoes

(24) The providing bednets for workers living on site.

(25) The appropriate elimination of waste of all types, including wastewater

(26) The provision of a safety specialist responsible for the preparation, implementation and maintenance of a comprehensive safety program

(27) For the rehabilitation and/or construction of fuel supply facilities, provision of fire-fighting equipment such as dry powder extinguishers

(28) Conducting fire fighting and leak checks training drills for the construction staff

(29) Prohibition of smoking as well as litter or weed build up in the area as these may pose fire risks

Community Relations

To enhance adequate community relations, the Contractor will:

(1) Follow the country and EA requirements, inform the population about construction and work schedules, interruption of services, traffic detour routes, and provisional bus routes, as appropriate.

(2) Limit construction activities at night. When necessary, ensure that night work is carefully scheduled and the community is properly informed so they can take necessary measures.

(3) At least five days in advance of any service interruption (e.g., water, electricity, telephone, bus routes – if any) the community must be advised through postings at the project site, at bus stops, and in affected homes/businesses.

Chance Find Procedures for Culturally Significant Artifacts

The contractor is responsible for familiarizing themselves with the following "Chance Finds Procedures" in case culturally valuable materials are uncovered during excavation:

(1) Stop work immediately following the discovery of any materials with possible archeological, historical, paleontological, or other cultural value; announce findings to project manager; and notify relevant authorities;

(2) Protect artifacts as well as possible using fences, plastic covers etc; and implement measures to stabilize the area, if necessary, to properly protect artifacts;

(3) Prevent and penalize any unauthorized access to the artifacts; and

(30) Restart construction works only upon the authorization of the relevant authorities.

Environmental Supervision during Construction

The bidding documents will indicate how compliance with environmental rules and design specifications will be supervised, along with penalties for non-compliance by contractors or workers. Construction supervision will be overseen by RREA ESMT and will require oversight of compliance with the contract requirements and the contractor's EMP.

APPENDIX E OIL SPILL RESPONSE PLAN

An environmental management plan for various activities will be developed in order to minimize and mitigate the effects of potential impacts that might arise during the construction, operation and post closure phases. However, unexpected accidents and emergencies might occur that require additional measures during transportation, and handling of the oil and lubricants. In this case, a contingency plan should be developed.

The contingency plan includes the identification of likely accidents and emergencies, outlining response scenarios, delegating responsibilities, and co-ordination with the proper authorities. Furthermore, the plan would serve as a reference for risk assessment and employee training.

In the case of an oil spill, the required response should be implemented in a timely fashion in order to minimize the impacts of the accident and it must be undertaken by qualified individuals, experienced in emergency response actions. Table E-1 below provides a summarized oil spill response plan.

Table E-1: Summarized Oil Spill Response Plan.

Potential emergencies	*Response*
Accidental leakage and/or spillage of the solid waste, liquid waste (during transportation), discovery of hazardous or infectious wastes	**Isolation** • When safe to do so, isolate the contaminants to prevent further dispersion of any contaminates • **Spill Clean-up and Disposal** • Clean-up and disposal of spilled material must be undertaken in a timely fashion with due regard for potential adverse environmental impacts, health and safety and regulatory requirements • In consultation with local EPA authorities and the facility's environmental management & monitoring consultant, the following steps shall be taken: o Locate and quantify the contamination o Assess the site conditions and environmental impacts o Assess potential for contamination, collection and repair o Deploy immediately the required personnel, materials and machinery to contain and clean-up the spilled material o Call in specialized spill response contractor or appropriate personnel and machinery as required **Spill Notification**

Potential emergencies	*Response*
	• Contact local EPA authorities to notify them of accident and many potential risks related to the percolation into groundwater or flow into surface water **Monitoring as a Follow up** • A monitoring program shall be developed and implemented to confirm the effectiveness of any required clean-up **Root cause Assessment and Corrective Action** • An investigation will be undertaken to determine the root cause(s) of the incident and to identify, if feasible, corrective actions that can be undertaken to ensure that the incident does not re-occur **Documentation** • Incident report, including photographs, clean-up documentation, including the results of analytical testing and root cause assessment and corrective actions

TERMS OF REFERENCES FOR AN OIL SPILL RESPONSE PLAN

The project owner shall prepare a simple and effective but financially and technically feasible OSRP. The OSRP shall be in compliance with internationally acceptable standards. The OSRP shall also:

- determine the responsibilities of each actor in the project: Environmental Protection Agency (EPA) and the Ministry of Land, Mines and Energy (MLME) and other Government of Liberia agencies, which have oversight statutory responsibilities;
- establish procedures, including notification and monitoring procedures, to be followed in case of an oil spill;
- analyze the cause of the oil spill and lessons learned;
- recommend the equipment and training needed to control and manage the oil spill; and,
- list the equipment to be procured with its associated costs.

Coordination and implementation of the project's environmental and social safeguards, including the OSRP, related to the subproject facilities, will be confirmed by the RREA, which will ensure adherence to the safeguard policies and OSRP by all agencies involved in the implementation of the SREP, including the contractors in charge of the construction during the construction phase, the operators involved in the operational phase.

APPENDIX F SCREENING CHECKLIST GUIDE

The initial screening of a sub-project will be undertaken by RREA ESMT in accordance with the process set out in steps F1, F2 and F3 below. The information required for these stages will be obtained by RREA ESMT through site reconnaissance and review of existing data sources. During the screening process, RREA ESMT will feedback to the project development team to improve the Environmental and Social Performance of the project, where issues become evident.

The following form should be included in the Project's Operational Manual

Sub-project name:
Sub-project location (include sketch/map: **(***e.g., county, district)*

Type of activity: *(e.g. construction, periodic maintenance)*

Estimate Cost:

Proposed date of commencement of work:

Technical drawing/specification reviewed: *(circle answer): Yes No*

This report is to be kept short and concise.

F.1 SITE SELECTION

When considering the location of a sub-project, rate the sensitivity of the proposed site in the following table according to the given criteria. Higher ratings do not necessarily mean that a site is unsuitable. They do indicate a real risk of causing undesirable adverse environmental and social effects, and that more substantial environmental and/or social planning may be required to adequately avoid, mitigate, or manage potential effects.

Issues	*Site Sensitivity*			*Ratings*
	Low	*Medium*	*High*	
Natural habitats	No natural habitats present of any kind	No critical natural habitats; other natural habitats occur	Critical natural habitats present	
Water quality and water resource availability and use	Water flows exceed any existing demand; low intensity of water use; potential water use conflicts expected to be low;	Medium intensity of water use; multiple water users; water quality issues are important	Intensive water use; multiple water users; potential for conflicts is high; water quality issues are important	

	no potential water quality issues			
Natural hazards vulnerability, floods, soil stability/ erosion	Flat terrain; no potential stability/erosion problems; no known volcanic/seismic/ flood risks	Medium slopes; some erosion potential; medium risks from volcanic/seismic/ flood/ hurricanes	Mountainous terrain; steep slopes; unstable soils; high erosion potential; volcanic, seismic, or flood risks	
Physical Cultural property	No known or suspected physical cultural heritage sites	Suspected cultural heritage sites; known heritage sites in broader area of influence	Known heritage sites in project area	
Involuntary resettlement	Low population density; dispersed population; legal tenure is well-defined; well-defined water rights	Medium population density; mixed ownership and land tenure; well-defined water rights	High population density; major towns and villages; low-income families and/or illegal ownership of land; communal properties; unclear water rights	
Indigenous peoples	No indigenous population	Dispersed and mixed indigenous populations; highly acculturated indigenous populations	Indigenous territories, reserves and/or lands; vulnerable indigenous populations	

Where sites are deemed to be of high sensitivity for a particular aspect, RREA ESMT will discuss options to avoid impacts such that the high sensitivity sites are not affected with the RREA Technical team developing the scheme.

Where the location is in an area of predominantly medium site sensitivity, options for the types of mitigation measures that are likely to be required will be discussed with the RREA Technical team developing the scheme, to ensure that they are acceptable.

F.2 CHECKLIST QUESTIONS

The following questions will provide high level understanding of the likely environmental and social impacts and therefore what further studies (or mitigation measures) will be required for each sub-project. The questions are provided in no particular order.

Physical data	***Yes/No answers and bullet lists preferred except where descriptive detail is essential***
Site area in ha	
Is the project within or close to settlements or dwelling places? Are schools or medical facilities or other sensitive features in the vicinity?	
Any existing property to transfer to sub-project	
Any plans for new construction	

Preliminary Environmental Information	***Yes/No answers and bullet lists preferred except where descriptive detail is essential***
State the source of information available at this stage (i.e., national/regional/local databases, walkover survey, verbal communication etc).	
Has there been litigation or complaints of any environmental nature directed against the proponent or sub-project?	

Identify type of activities and likely environmental impacts	***Yes/No answers and bullet lists preferred except where descriptive detail is essential***
What activities will the project require, and how can the receiving environment be affected:	
What are the likely environmental impacts, opportunities, risks, and liabilities associated with the sub-project?	
Are natural habitats/ rare or scarce species/ sensitive biodiversity receptors present	
Are there features of importance for Cultural Heritage/ buried archaeology in the vicinity	
Are there any surface water features (lakes, ponds, rivers, streams etc) present? How will they be affected?	
Are there any water abstraction points or known aquifers present? How will they be affected?	

Determine environmental screening category	***Yes/No answers and bullet lists preferred except where descriptive detail is essential***
After compiling the above, determine which category the subproject falls under based on the World Bank's environmental categories A, B, and C (no Category A projects will be implemented as part of this framework).	

Mitigation of Potential Pollution	***Yes/No answers and bullet lists preferred except where descriptive detail is essential***
Does the sub-project have the potential to pollute the environment or contravene any environmental laws and regulations?	
Will the sub-project require pesticide use?	
Has a detailed methodology been specified for the safe use of any	

potentially polluting materials, and is equipment incorporated in the design to constrain pollution within the laws and regulations and address pesticide use, storage, and handling.	
Does the design adequately detail mitigating measures?	
Are any special studies required to identify or clarify the extent or type of mitigation measures to be applied	

Public participation/information requirements	***Yes/No answers and bullet lists preferred except where descriptive detail is essential***
What consultation has been completed? Who are the likely affected parties?	
Indicate the time frame of any outstanding consultation process.	

Land and resettlement	***Yes/No answers and bullet lists preferred except where descriptive detail is essential***
What is the likelihood of land purchase for the sub-project?	
Will land be required temporarily for the project?	
What is the land use of the affected areas?	
Are there any special considerations for the land acquisition process (eg evidence of informal use; presence of vulnerable people)?	
Is social assessment/survey required?	

Actions
List outstanding actions to be cleared before sub-project appraisal:

F.3 F3 RECOMMENDATIONS FOR NEXT STAGES

Following the identification of sensitive receptors and of likely significant effects, each sub-project will be considered as described below to identify the next steps. Unless otherwise specified, RREA ESMT will be responsible for the decisions and resulting actions.

1. Are significant environmental or social impacts predicted that are sensitive, diverse or unprecedented? If so, consult World Bank representatives before taking further action.

   Action Taken:

2. Are environmental or social impacts predicted to be site specific (localized), potentially reversible or capable of being mitigated? If so, inform World Bank that ESIA or further environmental study is likely to be required. Prepare terms of reference and oversee the collection of this information.
   Action Taken:

3. Are environmental or social impacts likely to be few in number, and of low significance? Are the generic measures set out in the ESMF adequate to mitigate? Prepare list of relevant generic measures from ESMF for inclusion in the works contract documents.
   Action Taken (measures to be applied):

Reviewer:

Name: _____

Signature: _____

Date: _____

APPENDIX G MINUTES OF MEETING

Stakeholder Consultation – Environmental and Social Management Framework (ESMF) and Resettlement Policy Framework (RPF) Scaling-Up Renewable Energy Program (SREP)

Meeting: ESMF and RPF for Scaling-up Renewable Energy Program (SREP)

Date: October 15, 2015 (Start 10:15 AM – End 12:40 PM)

Venue: LEC Conference Room, Water Side, Monrovia, Liberia

Attendants:

Name	*Organization*	*Position*	*Contact*
M. Hady Sherif	CSET (NGO)	Executive Director	mhsherif@csetliberia.org
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Yasmin EL Helwe	Earthtime	Environmental Consultant	yhewe@earthtimegroup.com +231888242424
John K. Jallah Jr.	Environmental Protection Agency (EPA)	Assistant Manager - ERS	Jkj2g4@gmail.com
Z. Elijah Whapoe	Environmental Protection Agency (EPA)	Manager - Planning & Policy	zewhapoe@yahoo.com +231886524657
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Name	*Organization*	*Position*	*Contact*
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Adolphus Nippae	University of Liberia	Chair – Department of electrical engineering	+231886560929 +231777560929
Robert Robelus	World Bank	Senior Environment Specialist	robelus@gmail.com

Summary:

A meeting was held between Liberia Electricity Corporation, Rural & Renewable Energy Agency, Environmental Protection Agency, Ministry of Agriculture, Ministry of Interior Affairs, The World Bank, Forestry Development Authority and other relevant Ministries and Agencies to brief the attendees about the general Environmental and Social Management Framework (ESMF) and Resettlement Policy Framework (RPF) for a number of projects that fall under Scaling-Up Renewable Energy Program (SREP) in Lofa County.

Two presentations on the project (attached), tackling the RPF and ESMF respectively, were provided; Concerns were voiced and questions asked.

Presentation:

Irene Koksaeter, RPF Consultant - Multiconsult, presented the RPF section of the project. The presentation provided general guidelines that should be taken into consideration when applying resettlement action plans for the different projects under SREP. It also included a brief on the RAP process, the legal instruments and the institutional framework responsible for managing and implementing this process.

Wassim Hamdan, Managing Director - Earthtime, presented the ESMF section of the project. The presentation provided a description of the different SREP project components; it also included a brief on the EIA process in Liberia, which is a requirement by the EPA Management Law of Liberia. The presentation also included some of the potential environmental impacts of the projects that will fall under SREP as well as the institutional arrangement and the main entities responsible for the implementation of environmental and social management and resettlement plans for the projects.

Questions and Concerns Session:

The purpose of this section was to focus on the concerns of the major stakeholders on the project. Some concerns were discussed in the meeting, but mainly answers to the raised questions and concerns will be studied and included in the Final ESMF and RPF document.

The questions, concerns and comments raised during the meeting are presented in details in Table G-1 and Table G-2 below. The main concerns and comments discussed in the meeting can be as follows:

1- Focus on renewable energy (especially solar energy) instead of diesel plants, as diesel can have higher environmental impacts, and can increase the price of the provided electricity because of its direct relation with the market prices and high transportation costs.

2- Include the office of Lofa superintendent and other local authorities in the different phases of the projects especially the resettlement action plans and the compensation evaluation and grievance process.
3- Clearly indicate the status and ownership of the lands in case the project is decommissioned.
4- Include local authorities and expertise in the implementation and management of the project and allocate a percentage of the projects income to be used in other development projects in the communities.
5- Invest in building capacities in the different sectors related to the projects implementation and operation.

Table G-1: Questions, concerns and comments regarding the RPF

Institution	Name & Position	Concerns/ Questions/ Comments/Responses
Ministry of Internal Affairs (MOI)	Arthur Bestman - Assistant Superintendent – Lofa County	• Lofa has a unique administration system as it contains six different tribes. • The office of superintendent should be included in the steps of the grievance mechanism as well as the monitoring part of any RAP. o **Irene Koksaeter (RPF consultant, Multiconsult)**: This proposal will be taken into consideration and the office of the superintendent will be included in the grievance management as well as the monitoring process of the RAP. RREA will be requested to include someone from the office of the superintendent in their monitoring team. • The environmental protection act and the EPA should be included in the key legal instruments and participating institutions related to RAP.

Forestry Development Authority	Darlington Tuagben (Deputy Managing Director)	• How is FDA involved in the RAP processes?
		  o **Irene Koksaeter (RPF consultant, Multiconsult):** In case the project affects forest areas, the FDA should be included in the RAP process.
		• What is budget for resettlement for this project, as proposing 70% of the land value to be compensated is ambitious?
		  o **Stephen V. Potter Sr. (Program Director, RREA)**: The budget to be allocated for resettlement is not yet set at this level. For the World Bank to invest in the implementation of a project, it should be free of conflicts. The RAP document should be generated and approved and the actual resettlement completed before the start of the implementation. Funds allocated for implementing the project do not cover the resettlement costs. These costs should be provided by the government to complete resettlement activities before receiving funds for the implementation of the actual project.
		• What becomes of the acquired land after the project is decommissioned. Does it become government land or go back to the community?
		  o **Irene Koksaeter (RPF consultant, Multiconsult):** Usually, if the project is decommissioned, the ownership of the land should go back to the community that previously owned it.

Institution	Name & Position	Concerns/ Questions/ Comments/Responses
Environmental Protection Agency	Z. Elijah Whapoe (Manager - Planning & Policy)	• The EPA reviews resettlement action plans as well as environmental and social impact assessments reports as both are part of the environmental and social management process, so the EPA should be included in the list of institutions involved in monitoring and assessing the RAPs for every project. o **Wassim Hamdan (Managing Director, Earthtime):** Definitely we cannot overlook the EPA 's role and it will be included in the monitoring process of the RAP, as RAPs are a component of the ESIA that covers the social aspect and it should be approved by EPA prior to issuing the environmental permit. o **Irene Koksaeter (RPF consultant, Multiconsult)**: EPA should be included in the RAP processes, and if EPA is decentralized and have an office in the project area, RREA will have to incorporate someone from the EPA office in the monitoring team. • The office of the superintendent should be included in the grievance process of any RAP.
Rural & Renewable Energy Agency (RREA)	Stephen V. Potter Sr. (Program Director)	• RREA is an agency that implements renewable energy projects in rural areas of Liberia where the grid is not likely to reach. An initial investment of 50 million USD is split between the World Bank and the African Development Bank for the SREP project. The African Development Bank is focusing on identifying projects in the South-east of Liberia, while the World Bank area of focus is identifying renewable energy projects in Lofa County. Feasibility studies and optimization studies are being conducted in different areas including looking at possibilities of mini-hydro projects in Zorzor and Kolahun, and solar energy project in Voinjama. Main areas of focus are Kolahun and Foya districts and Voinjama and Zorzor cities as well as number of communities within an around the projects and transmission lines. Once the areas of focus are definite and decisions taken about implementing one or more of these projects, county authorities will be heavily involved.

Institution	Name & Position	Concerns/ Questions/ Comments/Responses
Unknown	Unknown	• What becomes of the acquired land after the project is decommissioned**?** o **Irene Koksaeter (RPF consultant, Multiconsult):** For aspects that will be permanently acquired they will belong to the government. Where the government have temporal acquisition then it does not have the right to own the land and the land will go back to the community it belonged to. If facilities are to be decommissioned, the communities that originally owned the land have the right to take it back if they want to • In case of conflict resolution, what happens if someone goes straight to the court? How does RAP address that? o **Irene Koksaeter (RPF consultant, Multiconsult)**: anyone has the right and the choice to go directly to court if they want to. Although we recommend following the steps and try to solve the conflict but we will support those who choose to go directly to the court as well.
Ministry of Agriculture (MOA)	Chea B. Garley (Assisstant Minister)	• The ministry do not have the capacity at county level at the moment and have a lack of capacities in some areas, how would this be dealt with? Will you communicate directly with the head of institution? o **Irene Koksaeter (RPF consultant, Multiconsult):** RREA will communicate with the assigned contacts of the ministry and keeps them updated with the work their surveyors are doing on the ground as well as trying to increase the ministries capacities.

Institution	Name & Position	Concerns/ Questions/ Comments/Responses
CSO / LIRDA	Daniel H. Allison (Executive Director)	• Is there any role the civil society organization and other NGOs can play in the RAP process? o **Irene Koksaeter (RPF consultant, Multiconsult)**: During resettlement a lot of support can be used from civil societies and NGOs as these are involved in many aspects of the communities and support RREA in the livelihood restoration efforts. The roles of civil society and NGOs can even extend beyond the resettlement phase to the implementation of the project. o **Stephen V. Potter Sr. (Program Director, RREA)**: RREA already has a working group called the Rural Energy Working Group in which the civil society takes part and any suggestion and recommendation from NGOs and civil society can be communicated through this group.
Land Commissioner	R. Jole Sherman (Program officer)	• Land compensation might be an issue as having a public certificate does not grant the ownership of the land: o **Irene Koksaeter (RPF consultant, Multiconsult)**: during the RAP preparation recommendations and information about land ownership made by the land commissioner will be taken in to consideration.
MEPECG (NGO)	Jacob S. Sandik (Evaluator)	• Who will be responsible for the management of the project during the implementation? Will the project be locally managed? The earlier the issues of sustainability and local management of the project are addressed the better. o **Stephen V. Potter Sr. (Program Director, RREA)**: RREA is not structured like LEC to own, operate and manage the system. Due to the lack of capacity in Liberia, RREA's role is to facilitate the process, seek donor funding and project implementation and facilitate the project construction process. However the project will be owned by a cooperative or an independent producer. In all cases the entity that will own the project will be involved in the process from the beginning and will be included in all phases of the project as much as possible.

Institution	Name & Position	Concerns/ Questions/ Comments/Responses
World Bank	Robert Robelus (Senior Environment Specialist)	• The RPF as well as the ESMF are guiding documents that will help in the preparation of RAPs and ESIAs in case a micro project has been identified. • There are some important differences between the country laws and the World Bank policy OP4.12: o OP4.12 give people the right of assets compensation even if they are illegal on land; people will not have the right of land compensation but they will have the right of assets compensation. o The aim of OP4.12 is that people should not be poorer after resettlement. Resettlement should keep at least an equal level of living or can be seen as a development opportunity. o Everyone has the right for Livelihood restoration o Special attention must be given to vulnerable households • The entitlement matrix is the most important part of the resettlement framework, as it is the part that makes the process of who is entitled to what clear. • A date limit should be set before the start of any compensation to prevent people from taking advantage of the compensation process.
GIZ ENDEV (NGO)	Hartlieb Euler (Renewable Energy Director)	• It is important to take lessons from actual RAPs that were already implemented to set rules in the RPF based on field experience.

Table G-2: Questions, concerns and comments regarding the ESMF

Institution	Name & Position	Concerns/ Questions/ Comments/Responses
GIZ ENDEV (NGO)	Hartlieb Euler (Renewable Energy Director)	• Based on an experience undertaken at GIZ office, solar energy is a lot cheaper than diesel, so it is recommended to put priority into looking at solar-hydro hybrid stations or solar stations options instead of diesel stations which will be economically more feasible and give an economical advantage for the distribution of current. o **LEC and RREA**: feasibility studies and different optimization options are still being considered and the general intention is to probably go towards solar and hydro-solar hybrid stations; decisions will be made once the studies are completed. Hydro and solar stations will also reduce the risk of transporting fuel from the cost inland.

Institution	Name & Position	Concerns/ Questions/ Comments/Responses
Forestry Development Authority	Darlington Tuagben (Deputy Managing Director)	• Capacity building is a very important point that should be emphasized like the trainings that used to be performed by EPA on biannual basis. • The potential impacts did not include spills related to diesel products and equipment, as well as habitat disturbance during project activities (like poles installation, etc) o **Wassim Hamdan (Managing Director, Earthtime)**: we did not include all the impacts in the presentations, but this concern has been addressed in the actual document and that's why for example an oil spill response plan is required for such projects.
Ministry of Internal Affairs (MOI)	Arthur Bestman - Assistant Superintendent – Lofa County	• What is the responsibility of the community in the project process? During operation, who will be managing and collecting power fees and will the community have shares of these fees? o **Wassim Hamdan (Managing Director, Earthtime)**: The financer of the project and RREA will make the decision regarding the owner and operator of the projects based on studies that should be conducted under component 2 of this project to determine the pricing levels based on different factors. o **Stephen V. Potter Sr. (Program Director, RREA)**: The purpose of the projects is to provide power on a commercial basis taking into consideration that everybody is entitled to access to power; this is why there will be different payment schemes that will be assessed based on studies including the willingness and ability to pay as well as other aspects. • Who are the members of the Environmental and social management unit (ESMU) and who suggests them? o **Wassim Hamdan (Managing Director, Earthtime)**: members of the ESMU will be hired by RREA. • Is there any local presence during the phases of the project? o **Wassim Hamdan (Managing Director, Earthtime)**: This is an advanced project that will need a professional entity to operate and manage in terms of technical and financial means, thus local management might not be possible at the first stages; however, the project will include local labour and expertise as much as possible in its different phases.

Institution	Name & Position	Concerns/ Questions/ Comments/Responses
Unknown	Unknown	• Diesel is not a renewable energy and it gets affected by the change in market prices which will affect the electricity price. It is advisable under the SREP to focus on projects related to renewable energy as these are more sustainable and more economically stable.
CSET (NGO)	Hady Sherif (Executive Director)	• It is important to use some of the studies and experiences that are being implemented to help in the decision of the best alternatives of the different projects.
MEPECG (NGO)	Jacob S. Sandik (Evaluator)	• Would it be more appropriate to look at the projects in Lofa area and manage them as one regional entity instead of micro-managing each project alone. o **Stephen V. Potter Sr. (Program Director, RREA)**: this issue will be looked at during the project implementation phase where different possible choices will be discussed. It constitutes part of the planning study that will be taken into consideration by the decision makers. • Most of the rivers in Lofa County do not have big waterfalls and strong slopes to create a water head; is there a possibility that the projects discussed will include building dams? o **Stephen V. Potter Sr. (Program Director, RREA)**: This issue cannot be decided at this stage as this conclusion will be based on the results of the ongoing feasibility studies and the detailed studies that are planned to assess the best option for generating power whether it includes building dams or creating hybrid station etc.
UNDP	Moses Massah (Project Manager)	• Why are we neglecting transmission lines in this project? o **Wassim Hamdan (Managing Director, Earthtime)**: this project tackles small grids that do not require transmission lines. Moreover, this is a broad project that presents general guidelines that should be followed in this type of work, specific components will be included in a case by case projects and an upgrade of the study will take place if the need arises to include transmission lines. • Are there any studies that take into consideration the wind energy? o **Wassim Hamdan (Managing Director, Earthtime)**: I came across few researches in the past that tackles wind energy, but these are not related to the current project. • It is advisable that projects to be developed fall under the Clean Development Mechanism and focus on renewable energy.

Institution	Name & Position	Concerns/ Questions/ Comments/Responses
Environmental Protection Agency (EPA)	John K. Jallah Jr (Assistant Manager – ERS)	• It is important to highlight the RREA should hire and environmental consultant for every micro-project that falls under the SREP. The environmental consultant is the entity that will communicate with the EPA and help them understand all the environmental and social issues that each project might face. Each project will need to submit different documents like a RAP and an environmental and social management plan, etc. in order to obtain required permits. Each project will have to apply for two permits one for construction and one for operation.
	Z. Elijah Whapoe (Manager - Planning & Policy)	• Renewable energy is a new and very promising sector. All the comments and concerns should be taken into consideration to make sure this project is achievable within the community and does not lead to major environmental and social impacts. The setup of an ESMU at RREA is a key step where in-house experts will interact with the environmental authorities to ensure that all the issues that might rise from the project are addressed. Consultations on project by project bases are another key step for the implementation of these projects.
National Charcoal Union of Liberia	Richard Dorbor (President)	• The level of income of the target receivers of power is very important. Using renewable energy instead of diesel can lead to steadier electricity pricing as the diesel prices can fluctuate with the market and diesel transportation costs can be high. Diesel transportation can be a hazard especially on the current road conditions. o **Wassim Hamdan (Managing Director, Earthtime)**: Even in good road conditions, transporting fuel for a long distance can constitute a major environmental hazard that should be avoided. Renewable energy, especially solar energy is probably the ultimate goal these projects should reach. • Almost 75% of the lands in Lofa are owned by communities. Can the communities have a dividend out of the electricity incomes in return for the lands they are providing so these shares can be used in other development projects? o **Wassim Hamdan (Managing Director, Earthtime)**: the owner should ensure careful siting of the project locations. These locations should be decided based on consultation with communities, studies and legal framework.

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Stakeholder Consultation Meeting
Environmental and Social Management Framework (ESMF) and Resettlement Policy Framework (RPF)
Scaling-Up Renewable Energy Program (SREP)
LEC Conference Room
October 15, 2015

Attendance Sheet

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18.					

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