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Elaboration of SE4ALL Investment Prospectuses in 8 of 15 ECOWAS member states

SE4ALL Investment Prospectus for Liberia

May 2017

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ABBREVIATIONS

AA	Action Agenda
AFD	Agence Française de Développement (France)
AFDB	African Development Bank
B / Bn	Billion
CA	Contracting Authority
DEVCO	Directorate General for Development and Cooperation – EuropeAid
DFID	Department for International Development (UK)
ECOWAS	Economic Community of West African States
ECOWAS	Economic Community of West African States
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EDF	European Development Fund
EE	Energy Efficiency
EIB	European Investment Bank
EPC	Engineering, Procurement & Construction
ESIA	Environmental and Social Impact Assessment
EU	European Union
EUD	European Union Delegation
EUR / €	Euro
FiT	Feed in Tariff
GIS	Geographical Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoSL	Government of Sierra Leone
GW / GWh	Giga Watts / Giga Watt hours
ha	Hectare
HIA	High Impact Action
HPFO	High Pour Fuel Oil
HPP	Hydro Power Plant
HV	High Voltage
IBRD	International Bank for Reconstruction and Development
ICF	International Climate Fund
IEC	International Electro-technical Commission
IFC	International Finance Corporation
IFI	International Financial Institution
IP	Investment Prospectus
IPP	Independent Power Producer
JICA	Japan International Cooperation Agency
KE	Key Expert
kW / kWh	Kilo Watt / Kilo Watt hour
LRMC	Long Run Marginal Cost
LV	Low Voltage
MDG	Millennium Development Goal
MOU	Memorandum of Understanding
Mtoe (1)	million toe (1 million toe = 11,65 MWh)
MV	Medium Voltage
MW / MWh	Mega Watts / Mega Watt hours
NGO	Non-Government Organization

NIP	National Indicative Programme
NKE	Non-key Expert
ODA	Official Development Assistance
OMVG	Organisation pour la mise en valeur du fleuve Gambie
OMVS	Organisation pour la mise en valeur du fleuve Sénégal
PPA	Purchase Power Agreement
PPP	Public Private Partnership
PV	Photovoltaic
RE	Renewable Energy
RESMP	Rural Energy Strategy and Master Plan
RREA	Rural and Renewable Energy Agency
REF	Rural Electrification Fund
RrE	Rural Electrification
SE4ALL	Sustainable Energy for All
SE4ALL	Sustainable Energy for All
SHP	Small Hydro Power
SME	Small Medium sized Enterprise
SUNRE	Sustainable Use of Natural Resources and Energy Finance
TAF	Technical Assistance Facility
ToR	Terms of Reference
ToR	Terms of Reference
UEMOA	Union Economique et Monétaires des Etats de l'Afrique de L'Ouest
UNFCC	United Nations Framework Convention on Climate Change
USD / $	United States Dollars
WAPP	West African Power Pool
WB	World Bank

ECHANGE RATES

Name of national currency:	Liberian dollar (LRD)
Exchange rate US Dollar:	1 US Dollar = 106.05 Liberian Dollar
Exchange rate Euro:	1 Euro = 115.88 Liberian Dollar
Date:	May 2017

1 EXECUTIVE SUMMARY

Liberia has a market-based economy open to foreign investment. The energy and power generation have some of the best prospects for investment. The Government of Liberia (GoL) is upgrading institutions, investment policies, and business regulation to improve the investment climate and ensure security for commercial transactions.

Adopted in 2016, the SE4ALL Action Agenda sets out Liberia's 2030 SE4ALL goals: 1) to increase access to electricity to 100% of the population; 2) to have 48% of the population using improved cook stoves, with LPG used as a cooking fuel by 43% of the households; 3) to achieve a 22.5% share of renewable energy-based generation; 4) to reduce electricity grid system losses to 10%; to have solar thermal systems in use in 53.9% of residences, to achieve 15% energy savings in industry and 14.1% savings in buildings.

The government's post-war (re-)electrification strategy is now in its final phase: rehabilitating the Mt. Coffee hydropower plant; completion of three transmission corridors in the environs of Monrovia; and regional transmission and distribution projects. The latter include a rural electrification program based on the cross-border transmission line from Cote d'Ivoire, the RREA Master Plan, and the Cote d'Ivoire, Liberia, Sierra Leone and Guinea (CLSG) interconnection project. In parallel, the country has undertaken to reform the electricity sector through unbundling of functions and development of a new institutional and regulatory framework.

The EU has supported the development of a Rural Energy Strategy and Master Plan for Liberia until 2030 (RREA Master Plan), that embodies Liberia's commitment to energy access and use of indigenous resources that are the cornerstones of Liberia's Agenda for Transformation and post-Ebola recovery strategy, both of which align closely with the SE4ALL goals. In the longer term, many of the mini-grids to be established under the RREA Master Plan are intended to be connected to the national grid.

While endorsing the long-term importance of the private sector to the achievement of national electrification and energisation goals, GoL officials have made it clear that in the near term the Rural and Renewable Energy Agency (RREA) will act as the main developer for generation, transmission, and distribution projects in rural Liberia. The first significant private sector involvement is foreseen to be as contractors to operate and maintain government-owned mini-grids. Several donors have undertaken pilot programs to establish mini-grids and are actively collaborating with RREA to define an approach for attracting private concessionaires to operate the mini-grids by establishing conducive tariffs, operational and service requirements. In the absence of a regulator, this is proving to be a challenge. SE4ALL has an important role going forward to support the government in the execution of the RREA Master Plan, particularly in supporting resource mobilization for identified projects, while at the same time, promoting the development and inclusion of private participants in the sector.

The investment prospectus contains a list of projects contributing to the achievement of the SE4ALL objectives that have been submitted by public or by private entities, for which funding is required. The financing sought can take various forms (grants, debt, equity), depending on the type of project. All projects are consistent with the government's vision and meet the criteria set out in the framework of this investment prospectus. They are organised into 5 "pipelines": the first two pipelines are related to access to electricity (on-grid and off grid); sustainable and clean cooking (biomass energy and biogas); energy efficiency; and finally, projects contributing to improve the investment environment.

Projects are presented in the table below, and individual Project Fiches are to be found in Annex 5. This investment prospectus is expected to evolve and be republished on a regular basis, in order to update information on financing for the projects described in the fiches, as well as to publish additional information on the listed projects which have become investment-ready.

Table 0: Summary of Projects Pipeline

IP Code	Name of the Project	Name of Sponsor	Project Costs (Million Euros)
Pipeline 2 - Off-grid (Mini-Grids and Standalone Systems)			
LI_P2_1	Wozi mini hydro	RREA	8.78
LI_P2_2	Bopolu micro Hydro	RREA	2.23
LI_P2_3	Robertsport micro Hydro	RREA	0.92
LI_P2_4	Gbedin Falls Small Hydro	RREA	27
LI_P2_5	Ya Creek Small Hydro	RREA	16
LI_P2_6	River Gee Small Hydro	RREA	11
LI_P2_7	Small Scale biomass to Energy Projects	RREA	1.7
Pipeline 5 - Enabling Environment			
LI_P5_1	Import tariff exemption for solar equipment	Ministry of Mines, Land, and Energy, Department of Energy	0.115
LI_P5_2	Capacity Building Programme	Ministry of Land, Mines (MLME), and Energy, Rural and Renewable Energy Agency (RREA), Liberia Electric Corporation (LEC)	2

2 DESCRIPTION OF THE INVESTMENT THESIS

2.1 Country and Economic Overview

2.1.1 Geographic and Demographic Background and Impact on the Energy Sector

Liberia is a West African country neighbouring Guinea, Cote d'Ivoire, and Sierra Leone. Its Atlantic Ocean coastline extends for 579 km. Liberia covers a land area of 111,369 sq. km (37,420 square miles). The 2008 census showed a total population of 3,489,072. Population in 2014 was estimated to be approximately 4.4 million. A census is planned for 2017 prior to the National elections. The urban share of the population is approximately 39% and of rural population (living outside Monrovia) 61%. Mean household size declined from 6.2 in 1984 to 5.1 in 2008. In 2008 the population was 1,764,555 males (51%) and 1,724,517 females (49%) and in 2010, the number of households was estimated to be 747,670.

Figure 1: Map of Liberia

Liberia's territory is comprised of three areas: mangrove swamps and beaches along the coast; wooded hills and semi-deciduous shrub lands along the immediate interior; and dense tropical rain forests and mountainous plateaus in the interior. Liberia has **40% of West Africa's rain forest**. The rain forest occupies roughly 45% of Liberia's land and is the source of its timber resources. The plateaus are cultivated for agriculture (27% of land) and the mountains (including Mount Nimba and Putu Mountain) are home to mineral resources—especially iron ore, gold and diamonds.

Table 1: Country geographic and demographic background

Indicator / Criteria	Value – Assessment - Statement
Area (km2)	111.369
Population (million) - 2014[1]	4,396
Population growth (%) - 2014	2,2%
Share of rural population (%)[2]	61%
Sources: World Bank / ECOWREX/Action Agenda	

[1] http://data.worldbank.org/country/liberia

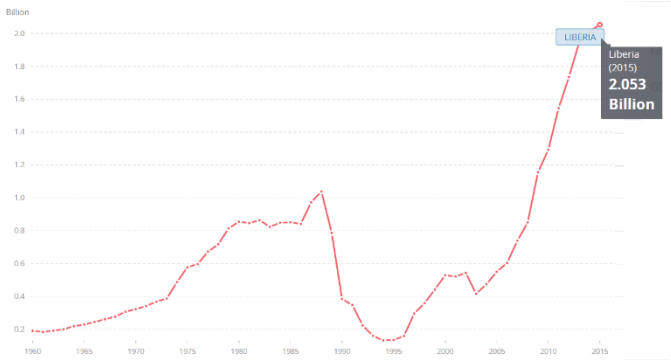
[2] SE4ALL Action Agenda

2.1.2 National Economic Background

Prior to the 1980s, Liberia was traditionally noted for its academic institutions, iron ore mining, and rubber plantations. Due to political upheavals beginning in the 1980s and a 14-year civil war (1989-2003) Liberia's economy was largely destroyed, with an accompanying steep decline in living standards. Poverty in Liberia over the last quarter of a century has spread and deepened, with thousands losing their livelihoods and becoming displaced. It is estimated that 76% of the population live on less than US$1 a day (an increase from 55% in 1997) and 52% live in extreme poverty of under US$ 0.50 a day.

For 2014, the World Bank estimated GDP to be USD 2.013 billion, for 2015 USD 2.053 billion with per capita GDP close to USD 460.

Figure 2: Gross Domestic Product (GDP) Evolution of Liberia (1960-2015) (current US$)



http://data.worldbank.org/indicator/NY.GDP.MKTP.CD?end=2015&locations=LR&start=1960&view=chart

Table 2: National economic background

Indicator / Criteria	Value – Assessment - Statement
GDP (billion USD, 2015)[3]	2,053
GDP per capita (USD, 2015)	380
GDP growth (%)	0,5%
Human development index (index/rank)	0,412 / 179
Share of population under poverty line (%)	>76%
Governance (Mo Ibrahim index) (index/rank)	49,3/31
World Bank doing business index (rank) (2015)	174/189
Sources: World Bank / ECOWREX	

2.1.3 Investment – Regulatory and Enabling Instruments

Ranked 174 out of 189 countries worldwide, Liberia has been and remains one of the lowest-ranked countries in doing business as indicated by the Doing Business Index (DBI). Through the National Investment Commission, Liberia aims to promote and coordinate investments in all sectors of the economy, providing incentives that include grants and tax exemptions.

According to a 2015 report by the US Department of State,[4] "the country has a market-based economy open to foreign investment". The sectors with the best prospects for investment include agribusiness, energy and power generation, infrastructure development, construction and real estate, and the

[3] http://data.worldbank.org/country/liberia
[4] U.S. Department of State 2015 Investment Climate Statement, May 2015

mining, manufacturing, transportation, and service sectors. The Government of Liberia (GOL) is upgrading institutions, investment policies, and business regulation. Legislation such as the Investment Law of 2010 establishing the Commercial Court and the Act for Small Business Empowerment aim to improve the investment climate and ensure security for commercial transactions.

Indicator / Criteria	Value – Assessment - Statement
Governance (Mo Ibrahim index) (index/rank)	49,3, the average for African countries
World Bank doing business index (rank)-2016	174/189
Sources: World Bank, http://mo.ibrahim.foundation/fr/iiag/ http://mo.ibrahim.foundation/iiag/data-portal/ http://www.doingbusiness.org/data/exploreeconomies/liberia	

Table 3: Investment – Regulatory and Enabling Instruments

The Electricity Law approved on 26th October 2015[5] aims to establish the legal and regulatory framework for the production, transportation, distribution and sale of electricity, to regulate import and export of electricity, as well as to define the rights and obligations of all entities involved in the sector. Among other provisions, the Law creates the Liberia Electricity Regulatory Commission (LERC) (or authority) to reside in the Ministry of Energy, the Rural Energy Fund (REFUND), (neither of which, at the time of writing, is yet operational), and the Rural and Renewable Energy Agency (RREA). The law also changed the mandate of the Liberia Electricity Corporation from national utility into a transmission and distribution company.

2.2 Energy Sector

2.2.1 Characterisation of the Energy Sector

Liberia's total primary energy consumption in 2010 was estimated to be 13,683 GWh, comprised for the most part (98.5% in 2010[6]) by firewood, charcoal, and petroleum, while electricity generation accounted for less than 2% of the mix. Renewable Energy is currently almost non-existent in the energy mix, although there is considerable hydroelectric, solar and biomass potential.

Table 4: Primary Energy by Source [7]

Fuel Type	MWh (2010)	(%)
Petroleum Products	1.826.565,69	5,24%
Electricity Generation	485.196,85	1,39%
Firewood*	29.215.717,95	83,76%
Charcoal	3.311.052,59	9,49%
Others(Hydro)	40.470,25	0,12%
TOTAL	**34.879.003,33**	**100,00%**

5 http://www.molme.gov.lr/doc_download/Ratified%20Electricity%20Law%20of%20Liberia%202015.pdf?a4705305cd27e04fb1f66830e7e0ef9d=ODA%3D

6 SE4ALL Action Agenda

7 SE4ALL Action Agenda

The electrification rate in Liberia is one of the lowest worldwide with only 1,4% of the population having access to electricity.

Table 5: The 2010 Total Population Access to Electricity[8]

Sector of the Population	For 2010 Population	Population Share %	Population Having Access	Access as % share of Total Population	Estimated Households Connected
Monrovia	1.127,487	29%	36.546	0,94%	7.166
Other Urban	388.789	10%	6.221	0,16%	1.220
Rural (68%)	2.371.610	61%	11.664	0,30%	2.287
TOTAL	**3.887.886**	**100%**	**54,430**	**1,40%**	**10.673**
Source: SE4ALL Action Agenda					

It should also be noted that the pre-war (1982) Electricity generation capacity of Liberia was 412,73 MW. During the war destruction and looting of infrastructures resulted in Liberia having a current estimated installed capacity of approximately 65 MW, 22 of which are operated by the Liberia Electricity Corporation (LEC), while the electricity tariff in Liberia is one of the highest worldwide at approximately 50 US cents/kWh[9]. As of March 1, 2017, the Board of Directors of the Liberia Electricity Corporation (LEC) has approved a reduction in electricity tariff from 49 cents to 39 cents per kilowatt hour (kwh).

Current Conditions

The energy sector in Liberia is characterized by the dominance of traditional biomass consumption and low access to poor quality and relatively expensive modern energy services. Over 95% of the population of the low-income category rely on firewood, charcoal, and palm oil, candles and kerosene for their cooking and lighting energy needs. Following tables display the Primary Energy Supply evolution in Liberia between 2000 and 2010 along with the contribution from different sources of Energy in 2010.

Primary energy supply is characterised by the dominance of traditional biomass (solid fuels) consumption and low access to poor quality and relatively expensive modern energy services. Over 95% of the population of the low-income category relies on firewood, charcoal, and palm oil, candles and kerosene for their cooking and lighting energy needs.

Table 6: The 2010 Total Population Access to Electricity[10]

Indicator / Criteria	Value – Assessment - Statement
Primary energy supply (Mtoe) (2010)	2,205
Primary biomass energy (Mtoe)	2,126
Primary renewable energy (Mtoe)	0,003
Primary fossil energy (Mtoe)	0,075
Final energy total (Mtoe)	1,177
Final modern energy BLEN (Mtoe)	0,006

[8] SE4ALL Action Agenda
[9] LEC, Press, Discussuons
[10] SE4ALL Action Agenda

Final electricity demand (TWh)	0,190
Note: (1 Mtoe=1 million toe = 11,65 MWh) *Sources: World Bank / TAF Country Fiche / ECOWREX*	

2.2.2 Policy, Institutional and Regulatory Framework

Liberia's energy policy is defined in the **National Energy Policy of Liberia** (NEPL), 2009[11] and the **Agenda for Action and Economic and Social Development,** 2009[12]. The principal objective of the National Energy Policy of Liberia 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".***

At the time of approval of the **NEPL**, the GOL reported that about 10% of urban residents and less than 2% of rural residents had access to electricity, and this limited access came largely from self-generation (non-LEC generation) using expensive imported fuel.

The NEPL established the following goals for 2015, consistent with the Millennium Development Goals (MDGs) as adopted by the Economic Community of West African States (ECOWAS):

a) **40%** of Liberian citizens living in rural and peri-urban would have access to improved stoves
b) **30%** of the urban and peri-urban population would have access to reliable modern energy services
c) **15%** of the rural population and 25% of the schools, clinics, and community centers in rural areas would have access to modern energy services.

In addition, the GOL is committed to promote the use of renewable energy such as solar and wind systems, as well as to pursue the development of mini and micro hydro on the country's numerous rivers and streams for rural electrification through the Rural and Renewable Energy Agency (RREA).

Prior to the NEPL, the **Draft Renewable Energy and Energy Efficiency Policy and Action Plan** (2007)[13] was issued, aiming to provide an input into the development process by exploiting Liberia's renewable energy resources to attract investment, market development, technology transfer and local capacity building in the renewable energy sub-sector in an environmentally sound manner.

Liberia's Investment Plan for Renewable Energy (IPRE) (2013)[14] aims to support the government's objective of increasing access to electricity and to accelerate the country's reconstruction and economic revitalization.

Frameworks and/or Agreements in support of Policy

In addition, the following policy frameworks and agreements are in force:

- SE4ALL Action Agenda (2015) and the Action Plans for Renewable Energy (NREAP) and Energy Efficiency (NEEAP),
  - Sets objectives and strategies on access, energy efficiency and generating capacity
  - Identifies $2B financing requirement – $120m/year - $40-60m/year for access
- **Economic Community of West African States** (ECOWAS) initiatives (2012 onward), including the **ECOWAS Renewable Energy Policy** (EREP) and the ECOWAS **Energy Efficiency Policy** (EEEP) (2012-2013), which include minimum targets and scenarios for renewable energy (RE) and energy efficiency (EE); the ECOWAS Renewable Energy Policy (EREP) has set a target of promoting 60,000 mini-grids and 2.6 million stand-alone systems across the region by 2020, at a total cost of €13.6 billion to serve 71.4 million people.

11 http://www.moci.gov.lr/doc/National%20Energy%20Policy%202009.pdf
12 http://pdf.usaid.gov/pdf_docs/Pnadq721.pdf
13 http://www.ecowrex.org/system/files/repository/2007_draft_re_ee_policy_liberia_-_cset.pdf
14 http://rrealiberia.org/forest/pg_img/Liberia%20IPRE%2010%2003%202013%20Final.pdf

- EU Joint Declaration with Liberia (April 2014), which reinforces:
  - Political ownership for energy policy by the Government of Sierra Leone, and
  - EU commitment to strengthening cooperation and support in energy.
  - EU ElectriFI and other EU mechanisms for potential technical and financial assistance

For 2014-2020, the National Indicative Programme (NIP) (which has been developed and agreed upon with the Liberia Government, allocates **€279m** of EU funding to support good governance, energy, education and agriculture. The EU has also been assisting in the country's recovery from the Ebola crisis.

In addition, Liberia benefits from regional funds earmarked for West Africa and from a number of thematic programmes. The European Investment Bank also provides support, primarily for infrastructure projects. (https://eeas.europa.eu/delegations/liberia/1437/liberia-and-the-eu_en)

- **The Power Africa Initiative in Liberia.** Liberia has signed the MOU with the United States Government (USG) to spur investments by the many partner companies and USG agencies that have signed up with the initiative. Action is needed to create national policy and financial environments that enable changes required for private sector investors, developers and financiers to participate actively in the electricity development sector of Liberia. (https://www.usaid.gov/sites/default/files/documents/1860/Liberia-MOU.pdf)

  Power Africa's engagement in Liberia is rooted in an agreement between the Millennium Challenge Corporation (MCC) and the Government of Liberia, signed in November 2015. The $257 million power and roads sector compact includes funding for the rehabilitation of the Mt. Coffee Hydroelectric Plant, development of a training center for technicians in the electricity sector, support for the creation of an independent energy sector regulator and support for the development of a nationwide road maintenance framework. Through USAID, Power Africa is providing complementary support to improve the operations of the utility and sector governance (https://www.usaid.gov/powerafrica/liberia).

INSTITUTIONAL SET UP

Currently, the electricity sub-sector in Liberia is comprised of the following institutions: The Ministry of Lands, Mines and Energy (MLME), the Liberia Electricity Corporation (LEC) and the Rural and Renewable Energy Agency (RREA).

The **Ministry of Lands, Mines and Energy** (MLME) was established by an Act of Legislature in 1972 to administer all activities related to land, mineral, water and energy resources exploration, coordination and development in Liberia. The three functional areas of the Ministry - lands, minerals and energy - are clustered under a Deputy Minister for Operations.

The Department of Energy (DOE), MLME is currently headed by an Assistant Minister for Energy and consists of the Bureau of Hydrocarbons and the Bureau of Energy Technology and Policy Development (presently called Bureau of Alternative Energy). The MLME is part of the Board of Directors of LEC and RREA. With the creation of the RREA, functions of the Department of Energy performed by the Alternative Energy Bureau are effectively transferred to the RREA.

The Rural and Renewable Energy Agency (RREA) is dedicated to the **commercial development and supply of modern energy services to rural areas** with an emphasis on locally available renewable resources. The RREA's mandate includes integrating energy into rural development planning; promotion of renewable energy technologies; facilitating delivery of energy products and services through rural energy service companies (RESCOs) and community initiatives;

Rural Energy Fund (REFUND) aiming to provide **low interest loans**, **loan guarantees**, and **grants** as targeted subsidies to ensure energy access by the poor. As of December, 2016, the fund has not been capitalized.

Electricity Regulatory Board (ERB) when fully operational, shall be responsible for monitoring and enforcement of all electric power policies, agreements, contracts and standards established. As of December, 2016, regulations were being considered for the ERB.

Liberia Electricity Corporation (LEC), a public corporation, was established in 1973 with the responsibility for generation, transmission and distribution of electricity throughout Liberia. The LEC had the mandate to supply electricity to the whole country (its supply network never reached much beyond Monrovia). Current (2016) total LEC installed generation capacity is 22.0 MW. Under the **2015 Electricity Law of Liberia**, LEC will be licensed and regulated by ERB, as an Independent Power Producer and Distributor, whose operations are regulated by ERB (Chapter 5 of the Electricity Law). It will be grandfathered to operate its current generating plants under separate licenses.

West Africa Power Pool (WAPP) in Liberia is presently responsible for construction management of the CLSG 225 kV transmission line extending from Côte d'Ivoire into Liberia and continuing on into Sierra Leone and Guinea.

POLICY AND REGULATORY FRAMEWORK

The purpose and scope of the Electricity Law entitled "**2015 Electricity Law of Liberia**" is to establish the legal and regulatory framework for the **production**, **transportation**, **distribution and sale of energy products and services** in Liberia, to regulate the import and export of electricity, and define the rights and obligations of all parties involved in the electricity sector, while creating the **Liberia Electricity Regulatory Commission** (LERC), the **position of Deputy Minister for Energy** for the Department of Energy of the MLME, the **Rural and Renewable Energy Agency (RREA)** and the **Rural Energy Fund** (REFUND). The law **converts the Liberia Electricity Company (LEC) into a transmission and distribution company** and provides for the amendment of all other enactments dealing with matters incidental or connected to the above.

To reduce the reliance on traditional fuel and increase the use of modern and renewable energy sources, through the National Energy Policy (2009) and Initial National Communication (2013), Liberia has set long term targets by 2030 including reduction of greenhouse gases by at least 10%, improvement of energy efficiency by at least 20%, share of renewable energy to at least 30% of electricity production and 10% of overall energy consumption, replacement of currently used cooking stoves with higher-efficiency (40%) stoves. In 2002, Liberia ratified the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, and developed its National Adaptation Programme of Action in 2008 followed by its Initial National Communication to the UNFCCC in 2012, and most recent communication is 2015 (source: Communication to UNFCCC, http://www4.unfccc.int/submissions/INDC/Published%20Documents/Liberia/1/INDC%20Final%20Submission%20Sept%2030%202015.002.pdf)

ENABLING ENVIRONMENT FOR PRIVATE INVESTMENT

Through the National Investment Commission, which was created by an Act of the National Legislature on September 6, 1979 and amended on July 19, 2010, Liberia aims to promote and coordinate investment-related activities in all sectors of the Liberian economy. Investment incentives can be accessed by foreign and domestic investors for approved investment projects for a wide range of sectors including Tourism, Manufacturing, Energy, Banking, and Agriculture, among others. Investment incentives include, i.a., capital allowances and exemptions from customs duties.

Land ownership is restricted to Liberian citizens. Therefore, land use by foreigners is only possible through leases. Leases are ordinarily for 25-50 years, but exceptions are permitted by law. In general, the ownership, leasing, and use of land are governed by both statutory and customary laws. Chapter III, Article 22, of the Liberian Constitution states: "Every person shall have the right to own property alone as well as in association with others, provided that only Liberian citizens shall have the right to own real property within the Republic. For enterprises owned exclusively by non-Liberians,

the total capital invested shall not be less than USD 500,000. For enterprises owned in partnership with Liberians and the aggregate shareholding is at least 25 percent, the total capital invested shall not be less than USD 300,000. Exemptions and allowable deductions are set out in Section 16 of the Consolidated Tax Amendment Act of 2010, while the maximum corporate income tax rate in Liberia is 25 percent, except in the case of mining companies, which may pay up to 30 percent[15].

Table 7: Institutional framework of the energy sector

Indicator / Criteria	Value – Assessment - Statement
Electricity/Energy regulator	Liberia Electricity Regulatory Commission (LERC).[16]
Operators in the electricity sector	Liberia Energy Corporation (LEC) - Transmission; Some Regional Distribution Companies
Institution in charge of rural electrification	RREA
Institution in charge of renewable energy	Renewable Energy Policy is formulated and exercised by the Ministry of Energy, Renewable Energy Unit.
Institution in charge of energy efficiency	There is no Institution in charge of Energy Efficiency so far. Energy Efficiency Policy is formulated and exercised by the Ministry of Energy, Energy Efficiency Unit.
Source:	*National SE4Focal Point / EU TAF Expert team / ECREEE*

2.3 Energy Sector Trajectory

2.3.1 Electricity Sector

Starting from a point of highly limited access to electricity, limited electricity production capacity, an energy sector characterized by the inefficient use of biomass and low exploitation of renewable energy, Liberia has large potential for the improvement of the Energy Sector.

The Energy/Electricity Sector needs to develop along three main lines, namely: development of the transmission (and distribution) network, development of grid-connected power capacity, development of mini-grids and integration of the above into a unified electricity production and distribution system, in which renewable energy will play a major role.

Status of Production, Transmission and Distribution of Electricity

Grid, mini-grids, and isolated power generation systems in Liberia are as below:

- **The National Grid Operated by the Liberia Electricity Corporation;** The National Grid is operated by the Liberia Electricity Corporation (LEC). LEC Electricity generation capacity currently consists of two 22 MW generators at the Mt. Coffee hydroelectric power plant. Two additional 22 MW generators are scheduled to be on-line by July, 2017. In addition, and thermal units (HFO and Diesel).

Table 8: Installed Grid-Connected Power Capacity and Generation - by Fuel (2010/0

Installed Grid connected Capacity (2010)

[15] http://investliberia.gov.lr/
http://www.state.gov/e/eb/rls/othr/ics/2015/241633.htm
http://www.state.gov/documents/organization/241845.pdf

[16] As of this writing, the regulatory commission has not been established, nor have the regional distribution companies been organized.

Fuel Type	MW	% of Total
Hydro	22	27%
HFO	38	46%
Diesel	22.5 (*)	27%
Gasoline	0,0	0%
TOTAL	***82.5***	***100%***

(*) HSD (High Speed Diesel Generators): installed capacity; to be removed from service.

- **Large and Small Capacity Power Mini-grids operated by Concession Companies;** These include the Mining, Logging, and Agriculture Concession Companies (mainly rubber, and palm oil concessions), including the 4MW Firestone hydroelectric facility which is still operational, and several diesel units. Mining, agricultural and other concession companies, have included in their concession agreements the right to operate their own power generation units within their concession areas.
- **Small Industrial, Commercial, International Organizations, Missions and other Private Power Capacity Isolated and Mini-Grids;** There are a number of small-to-medium sized units in the greater Monrovia area, used as stand-by units, serving small-scale industrial, commercial and service sector companies, diplomatic missions, and the like.
- **LEC Rural Electrification Outstations Systems;** There used to be 11 rural mini-grid systems operated by LEC in the early 1980's, but these are no longer operational, having been destroyed or looted during the war.
- **Emerging IPP Mini-Grids;** Currently, several IPPs (privately owned generators and limited municipal mini grids) are operating in Liberia in areas such as Duazon (suburb of Monrovia), Robertsport, Gbarnga, and Buchanan.

As per the SE4ALL Baseline Report for Liberia, pre-war electricity generation capacity of Liberia was **412,73 MW** in 1982. During the war, destruction and looting of infrastructures decimated the system. A recent assessment (2015) has indicated that current power generating capacity in Liberia has recovered to 114.42 MW including LEC's capacity of 22.64MW, with the total estimated self-generation capacity to be 91,78 MW, as shown below.

Table 9: Self-Generation Capacity (2015), by use

Use	2015 CAPACITY (MW)	%
Small Scale Industries, Commercial, Administrative and GoL Services	54,90	59,8%
Iron Ore Mining Concessions	13,71	14,9%
Rubber Concessions	11,75	12,8%
Other	11,44	12,4%
TOTAL	**91,78**	**100,0%**

ACCESS TO ELECTRICITY - TARGETS

As per Table 10 below, Liberia's target for "access to electricity" by 2030 is 100% (source: NREAP).

Table 10: Electricity Access Targets

	2010	2015	2020	2025	2030
Population with access to electricity (%)	**1,4%**	**1,4%**	**34,2%**	**67,1%**	**100,0%**
Share of population connected to the grid (%)	1,3%	1,4%	31,2%	61,9%	95,0%
Share of population served by renewable energy and hybrid mini-grids (%)	0,1%	0,0%	3,0%	5,2%	5,0%

Number of RE/hybrid mini-grids			***23,00***	***25,00***	***30,00***

The rural population served with grid-connected electricity services is planned to increase from practically 0% in 2015 to 29% by 2020 and to 91% in 2030, with the remaining rural population to be served through renewable mini-grids from 0% in 2015 to 5% in 2020 and 8% in 2030. By 2030, it is expected that in addition to this, the remaining rural populations will be served by other stand-alone and off-grid systems.

Table 11: Targets and Estimated Trajectory for Rural Population Served by Electricity

	2010	2015	2020	2025	2030
Rural population served with grid connected electricity services (% of total)	0,1%	0,0%	28,6%	57,0%	91,0%
Rural population served with mini-grid renewable electricity services (RE only and hybrid) (%)	0,2%	0,0%	4,9%	8,6%	8,2%
Remaining Rural Population & Population served by Other Stand-alone / off-grid services (%)	99,7%	100,0%	66,5%	34,4%	0,8%
Share of rural population served with grid, off- / mini-grid and stand-alone RE electricity services (%)	**0,3%**	**0,0%**	**33,5%**	**65,6%**	**99,2%**

Expected Electricity Demand / Supply - Targets

It is understood that to forecast energy/electricity demand scenarios, can prove to be a challenging exercise, since besides the uncertainties involved in the macroeconomic environment (especially in the long term) technical, economic, institutional (e.g., capacity building) issues need to be overcome. That is why projections taken from different sources present discrepancies regarding the trajectory of the electricity sector in the coming years.

Below, the electricity sector forecasts are presented from three sources:

- the “Action Agenda” (AA),
- the “Liberia Rural Energy Strategy and Action Plan” (RESAP) and
- the “Options for the Development of Liberia’s Energy Sector” (ODLES).

There are significant differences among the Energy demand Projections presented in these sources/studies. Similar discrepancies are displayed in the estimated installed capacity taken from the three sources (Tables 12 and 13).

Table 12: Electricity Supply and Demand Projections

Source		Total Supply & demand (GWh)	
		2020	2030
Action Agenda / On Grid		1.541,5	5.694,3
Liberia Rural Energy Strategy and Master Plan		1.173,2	2.297,6
World Bank, October 2011	Low Scenario	1.886,8	3.269,3
	High Scenario	3.394,2	6.532,2

a) Action Agenda
b) Liberia Rural Energy Strategy and Master Plan (http://liberiaruralenergy.org/?q=content/documents)
c) Options for the Development of Liberia’s Energy Sector, AFTEG Energy Sector Policy Notes Series, October 2011, Africa Energy Unit (AFTEG), Sustainable Development Department, Africa Region, The World Bank, http://siteresources.worldbank.org/EXTAFRREGTOPENERGY/Resources/717305-1266613906108/Liberia_Energy_ESW_11-4-11web.pdf

Targets, from the same three sources, are presented in Table 13 below.

Table 13: Targets for Grid Connected Installed Capacity from AA, LRESMP & World Bank

	2010	2015	2020	2025	2030
ACTION AGENDA					
Fossil Fuel based Generation Capacity (MW)	12,85	39,24	25,31	81,04	362
Small Scale Hydro installed capacity (MW) (excluding medium and large hydro)	4,57	4,57	4,57	4,57	4,57
Additional hydro (>30 MW) capacity installed (MW)	0	0	45,63	91,25	91,25
Additional - Other RE capacity (Solar PV, Wind, and others excluding hydro) (MW)	0	0	26,35	52,71	52,71
RE Capacity (MW)	4,57	4,57	76,55	148,53	148,53
TOTAL INSTALLED CAPACITY in MW	**17,42**	**43,81**	**101,86**	**229,57**	**510,53**
TOTAL POWER GENERATION in GWh	**190,0**	**418,0**	**1,541,5**	**3,266,8**	**5,694,3**
Liberia Rural Energy Strategy and Master Plan					
On-grid systems			1086,4	1588,7	2103,3
Decentralized systems			59,3	88,2	149,6
Mini-grids			24,4	33,9	39,6
Individual off-grid systems			3,0	4,3	5,0
TOTAL SUPPLY & demand (GWh)			**1173,2**	**1,715,1**	**2,297,6**
World Bank, October 2011-					
Low Scenario					
Monrovia Electrical Grid	18,66	34,30	41,98		63,15
Other on-grid (WAPP, Côte d'Ivoire Interconnection)	0,37	1,70	2,51		5,00
Urban and Rural Off-grid	0,98	4,84	7,26		14,61
Non-Monrovia Industrial: Off-grid	16,50	71,00	191,00		324,00
Non-Monrovia Industrial: Potential On-grid	0,00	0,00	59,00		91,00
Total On-grid	***19,02***	***36,00***	***103,49***		***159,15***
Total Off-grid	***17,48***	***75,84***	***198,26***		***338,61***
Total Electricity Demand (MW)	**36,51**	**111,84**	**301,75**		**497,76**
Total Electricity Demand (GWh)	**230,24**	**709,13**	**1,886,83**		**3,269,27**
High Scenario					
Monrovia Electrical Grid	19,66	54,50	75,58		149,99
Other on-grid (WAPP, Côte d'Ivoire Interconnection)	0,44	3,97	5,09		12,06
Urban and Rural Off-grid	1,19	10,07	13,18		30,63
Non-Monrovia Industrial: Off-grid	16,5	121,00	341,0		574,0
Non-Monrovia Industrial: Potential On-grid	0,0	50,0	109,00		216,00
Total On-grid	***20,10***	***108,47***	***189,67***		***378,05***
Total Off-grid	*17,69*	*131,07*	*354,18*		*604,63*
Total Electricity Demand (MW)	**37,79**	**239,54**	**543,86**		**982,68**
Total Electricity Demand (GWh)	**239,1**	**1,512,3**	**3,394,2**		**6,532,1**

NB. It is understandable that such discrepancies - as presented above - exist, owing to the differences among the assumptions on which they are based, the varying periods in which studies have been conducted, as well as the dynamics and the volatility of the energy sector in the country, not to mention strong variability in the underlying economic conditions.

The Figure below presents on-grid demand projections made by various institutions and consultants for the period 2005 - 2040, the dispersion of projections is very wide, with quite divergent figures for the years following 2020. (Source: *Evaluation of EU energy funding in Liberia and recommendations, Final Report, August 3rd, 2012, contract 2012/284032*).

The electric power demand / generation from **grid** and **off-grid or mini-grid** power sources for the period until 2030, which is considered as the basis for the elaboration of this Investment Prospectus, is given in Table 14, below.[17].

Table 14: Targets of grid and off/mini-grid renewable energy generation (GWh)

YEAR	2010	2015	2017	2020	2025	2030
Small hydro (up to 30 GWh) Off/Mini-Grid	39,5	39,5	39,5	39,5	39,5	39,5
Medium and Large Hydro (more than 30GWh) GRID			157,7	394,2	788,4	788,4
Solar (Off/Mini-Grid) (GWh)			91,1	227,7	455,4	455,4
Wind (Off/Mini-Grid (GWh)			0,1	0,2	0,5	0,5
Total RE Generation (GWh)	39,5	39,5	288,4	661,6		
Other Generation (FF; Baseline)	150,5	378,5	533,5	880,1	1283,8	1283,8
Total Generation RE Case (GWh)	**190,0**	**418**	**821,8**	**1541,7**	1983,5	4411

Table 15 presents the "Equivalent" installed capacity up to year 2030 required to meet the projected energy demand. The analysis presented in the Action Agenda and the RE Action Plan for Liberia calculates "Equivalent" installed capacity as though all energy assets/projects were operating at 100% Capacity Factor, which of course is not the case, In other words, the transformation between GWh and GW is based on a theoretical minimum generation time of 24 hours per day and 360 days per year.

Table 15: Targets of grid and off/mini-grid renewable energy installed capacity (MW)

YEAR	2010	2015	2020	2025	2027	2030
Small hydro (up to 30 MW) (Off/Mini-Grid)	4,6	4,6	4,6	4,6	4,6	4,6
Medium and Large Hydro (more than 30MW) Grid	-	-	45,6	91,3	91,3	91,3
Solar (Off/Mini-Grid) (MW)	-	-	26,4	52,7	52,7	52,7
Wind (Off/Mini-Grid) (MW)	-	-	0	0,1	0,1	0,1
Total RE Capacity (MW)	4,6	4,6	76,6	148,6	148,6	148,6
Other Generation Capacity (FF; Baseline)	17,4	43,8	101,9	229,6	316,4	510,5
Total Generation RE Case (MW)	**22**	**48,4**	**178,4**	**378,2**	**465**	**659,1**

Taking into consideration the assumption above and the Electricity generation trajectory in Table 14, the corresponding projected installed capacity per year in MW is displayed in Table 15, above. It should be noted that the figures presented assume the "avoided" energy demand and corresponding installed capacity resulting from the implementation of Energy Efficiency actions, measures and interventions.

2.3.1.1 Large-scale Generation and Transmission

Post-war, some progress has been made with the on-going rehabilitation and expansion of the Monrovia grid, as well as i) the Cross Border Rural Electrification project connecting the Côte d'Ivoire network to three Northern and Eastern counties of Liberia, completed in mid-2013 and ii) the "Côte d'Ivoire-Liberia-Sierra Leone-Guinea" (CLSG) project, being implemented by the West African Power Pool (WAPP) (Figure 4 - source: Rural Energy Strategy And Master Plan For Liberia Until 2030). Electricity transmission and distribution infrastructures as per the RESMP actions related to energy (electricity access, efficiency, etc.) are being organized around 5 axes, namely, a) the Growing the National Grid (**GTG**) Program, including all rural energy investments related to the National Grid, either High Voltage transmission or Medium Voltage distribution, b) the Decentralized Grids (**DG**) Program including all "grid-based" rural electrification investments in areas to be connected after 2030, c) the Beyond the Grid (**BTG**) Program, dedicated to electrification based on stand-alone individual systems,

[17] NREAP, NEEAP, SE4ALL Action Agenda for Liberia

d) the Other than Power (**OTP**) Program and e) the Building Capacity Program (**BCP**) dedicated to energy efficiency and access to other sources of energy for cooking or heating.

Figure 3: Existing (2015) and Projected Liberia Power Grid[18]

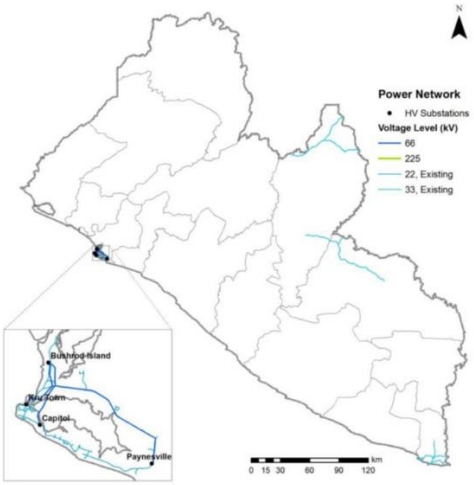


Figure 2.2 – Existing electrical power grid of Liberia (2015).

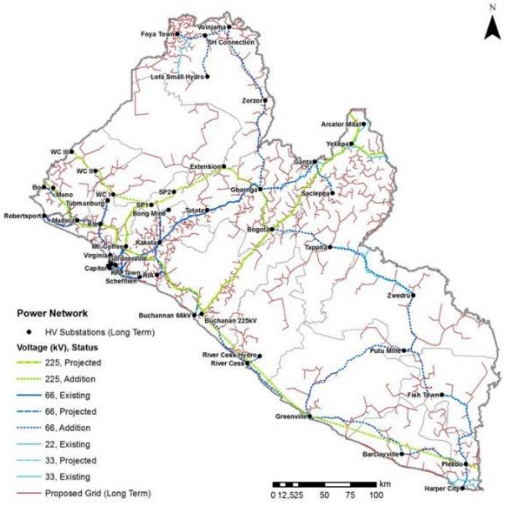


Figure 3.1 – Vision for the long term national grid of Liberia.

The GTG Program is composed of four main initiatives:

- **GTG.1 – Monrovia corridors electrification initiative**, whose objective is to promote the extension of Monrovia's existing network to the West, North and East of the Capital.
- **GTG.2** – **Gbarnga** corridors electrification initiative, whose objective is to promote the extension of the national network from the future substation of Gbarnga, located near a proposed future switching station of the CLSG.
- **GTG.3 – CLSG** electrification initiative, whose objective is to promote the extension of the national network from the future substations of the CLSG system, and from the power line itself
- **GTG.4** – On-Grid Renewable IPP, whose objective is to launch the procurement of renewable on-grid generation based on solar, biomass or mini-hydro.

The Action Agenda projects that grid-connected electricity production (including rural areas) will reach **510** MW by 2030, of which **148** MW **from renewable sources**, with the remaining **362** MW based on fossil fuels (Table 16).

Table 16: Targets for Grid Connected Installed Capacity

In MW Installed Capacity	2010	2015	2020	2025	2030
FF based Generation Capacity (MW)	**12,85**	**39,24**	**25,31**	**81,04**	**362**
Small Scale Hydro installed capacity (MW) (excluding medium and large hydro)	4,57	4,57	4,57	4,57	4,57
Additional hydro (>30 MW) capacity installed (MW)	0	0	45,63	91,25	91,25
Additional - Other RE capacity (Solar PV, Wind, and others excluding hydro) (MW)	0	0	26,35	52,71	52,71
RE Capacity (MW)	**4,57**	**4,57**	**76,55**	**148,53**	**148,53**
TOTAL INSTALLED CAPACITY in MW	**17,42**	**43,81**	**101,86**	**229,57**	**510,53**

Source: http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Liberia_-_Infrastructure_and_Inclusive_Growth_-_Full_Report.pdf, page 153.

[18] Rural Energy Strategy And Master Plan For Liberia Until 2030

2.3.1.2 Rural Electrification

By 2030, it is expected that 100% of the rural population will have access to electricity through stand-alone or mini-grid applications, up from the current 0.3% (Table 17).

Table 17: Targets for Off-Grid Installed Capacity

In MW Installed Capacity	2010	2020	2030
Share of Rural Population Served with Off-Grid (mini-grids and stand-alone) Renewable Energy Electricity Services in %	0,3%	34,5%	100%

2.3.2 Petroleum Products / LPG

Liberia's target for universal access to improved cook-stoves is 100% by 2020 and includes a target for increasing the share of the population served with modern fuel alternatives, including LPG, for cooking to 36% by 2020 and 41% by 2030.

In order for Liberia to achieve this target, several measures should be undertaken including, but not limited to:

- Modernization of the regulatory framework
- Widespread communication of information on the use of LPG for cooking in households to the public
- Incentives to encourage private LPG retail/service companies to build up distribution networks and retail outlets
- Develop financial schemes to allow LPG marketers to offer micro-finance schemes

2.3.3 Biomass and Traditional Energy Usage

Charcoal and firewood cook-stoves are presently the predominant cooking technology (74% of households in 2010). Through the implementation of a set of measures to achieve universal access to modern cooking ("Cooking Plan"). It is expected that the share of the population using improved cook-stove technologies may reach 95% by 2030 as displayed in Table 18.

Table 18: Scenario with measures to achieve universal access to modern cooking

	2010	2015	2020	2025	2030
Share of Population Using Improved Cook-Stoves in %	15%	15%	26%	37%	48%
Share of households using an alternative technology (%)	1%	1%	2%	4%	5%
Share of households using LPG (%)	10%	10%	21%	32%	43%
Total families using modern cooking devices (%)	**26%**	**26%**	**49%**	**72%**	**95%**
Remaining Households Using "Coal Pot" and Firewood Cooking Devices	74%	74%	51%	28%	5%

2.3.4 Energy Efficiency and Demand Side Management

The NEEAP forms the basis for the planned interventions and sets the targets for energy efficiency in Liberia along 5 main axes, namely:

- Reduction of losses in domestic and public lighting;
- Reduction of losses in the electric grid;
- Reduction of losses in the building sector; and
- Reduction of losses in the industrial sector,
- and, in parallel, establishment and enforcement of EE Standards and labelling

Domestic and Public lighting

The penetration rate of **on-grid, off-grid and public** lighting is projected to follow the trend shown in Table 19, below.

Table 19: Targets for energy efficient lighting

YEAR	2015	2016	2017	2018	2019	2020
Penetration rate of **on-grid** energy efficient lights (%)	0	33%	67%	100%		
Penetration rate of **off-grid** energy efficient lights (%)	0	17%	35%	75%	90%	100%
Percentage of high efficiency **public street** lights (%)	0	100%	100%	100/%		

Transmission and Distribution

Grid losses, estimated to be around 28% of the energy generated are aimed to be reduced to 10% by 2030, an equivalent of 801 GWh/year which could be translated to 90 MW of installed capacity (operating at a theoretical 100% capacity factor).

Table 20: Targets for reduction of distribution losses

YEAR	2010	2015	2020	2025	2030
Total of losses in the power system, including technical and non-technical losses, in both transmission and distribution (% of power available: generation + balance of imports and exports),	28	28	18	10	10

Building Sector

The baseline scenario predicts the annual power consumption in buildings to be 40% of power generation per year for the 20-year planning period. Through introduction of energy efficiency measures, energy efficiency savings are expected to reach 250 GWh or 14,1% by 2030, as displayed in Table 21 below.

Table 21: Energy efficiency in buildings

YEAR	2010	2015	2020	2025	2030
Baseline scenario ("baseline") for EE in buildings					
Annual electricity generation GWh	190	418	1,542	3,267	5,695
Consumption in the building sector (GWh)	76	67	368	809	1,780
Scenario with measures to improve the energy performance of buildings					
Building sector consumption, with EE measures (GWh)	76	97	351	733	1,530
Savings (GWh/year)			17	76	250
Savings (%)	0%	0%	4,7%	9,4%	14,1%

To achieve the targets for energy efficiency in buildings, the GOL plans, in addition to other measures, to implement support programs and energy efficiency performance certification for public buildings, in accordance with the ECOWAS directive on Energy Efficiency in Buildings.

Industrial Sector

Liberia's industrial sector comprises mainly mining and construction industries, along with a number of SMEs. The baseline scenario consumption, as well as the potential energy efficiency gains for the period up to 2030, are presented in Table 22, below.

Table 22: Energy efficiency in industry

Year	2010	2015	2020	2025	2030
Baseline scenario ("Baseline") for EE in Industry					
Annual total electricity generation GWh	190,00	417,99	1,541,70	3,267,26	5,694,76
Consumption in the industry sector (GWh)	38	84	184	405	890
Scenario with measures to improve EE in industry					
Consumption in the industry sector (GWh)	38	84	174	361	757
Savings, (GWh/year)			9,85	43,35	133,51
Savings, (%)	0%	0%	5%	11%	15%

Standards and Labelling

A number of energy efficiency standards and labelling actions are foreseen for the implementation of the EE strategy, such as:

- Introduction and enforcement of a number of energy efficiency standards in the country
- Introduction of efficient lighting standards (on-grid / off-grid and street lighting)
- Introduction and enforcement of standards for appliances (refrigerators, air conditioners, washing machines, electric water heaters, fans, transformers, etc.)
- Introduction and enforcement of energy efficiency labels
- Introduction and enforcement of efficient lighting labels (on-grid / off-grid and Street lighting)

2.4 SE4ALL Initiative

2.4.1 Overview

General SE4All framework

The Sustainable Energy for All (SE4ALL) initiative is a multi-stakeholder partnership between governments, the private sector and civil society. Launched by the UN Secretary-General in 2011, it has three interconnected objectives to be achieved by 2030:

- Ensure universal access to modern energy services;
- Doubling the overall rate of improvement in energy efficiency;
- Doubling the share of renewable energies in the global energy mix.

The ECOWAS Authorities mandated the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) to act as SE4ALL Focal Point in the West African region. In collaboration with its partners, ECREEE initiated the preparation and adoption of two regional policy documents: 1) ECOWAS Renewable Energy Policy (EREP) and 2) ECOWAS Energy Efficiency Policy (EEEP).

In 2014 and 2015 ECREEE supported the ECOWAS Member States in the development of their SE4ALL Action Agendas, i National for Renewable Energy Action Plans (NREAP) and National Energy Efficiency Action Plans (NEEAP). These documents - validated by each government - provide

a strategy with energy objectives and trajectories, and are supported by national policies. The national SE4ALL Action Agendas include the actions that are required to achieve the SE4ALL objectives in West Africa and thus make it possible to envisage the preparation of investment prospectuses (IP) prepared at the national level by the ECOWAS countries on the basis of a bottom-up approach, which consists in developing a pipeline of projects showing the effort and the timetable to bring each identified project to maturity and its "bankability".

The Action Agendas aims to demonstrate how the three objectives of SE4ALL can be achieved in a given country. It addresses the issues and gaps identified in the Rapid Assessment / Gap Analysis, defining and prioritizing various actions. It also clarifies the role of energy services in various sectors and how efforts in the field of access to energy, energy efficiency and renewable energy sources can contribute to the achievement of national energy development. Given the role of access to energy as a catalyst for water security, public health, education, income generation, women's empowerment, Governance and Sustainable Development, this transparent and intersectoral planning must be facilitated through inter-ministerial consultations.

The SE4ALL Country Action Reference Document (CARD) foresees the following steps for the implementation of the SE4ALL Country Action:

1. A **Declaration of Partnership** through which the Federal Government expresses desire to participate in the SE4ALL initiative;

2. A **Rapid Assessment/Gap Analysis**, which describes the status quo regarding energy in the national development context, providing the political, economic, social, and environmental background for the subsequent drafting of strategic plans to promote SE4ALL in Nigeria;

3. A **Country Action Agenda** which is a strategy-driven and holistic document that addresses the issues and gaps identified in the respective Rapid Assessment/Gap Analysis by outlining and prioritizing various courses of action and demonstrates how the three goals of SE4ALL can be achieved; the Action Agenda has been validated.

4. **Investment Prospectus**, which provides an approach to operationalizing the Country Action Agenda, in each specific sector or subsector, by identifying and developing a set of implementable programs and projects, including their investment requirements, that can be presented to potential private and public investors.

ECOWAS – ECREEE framework

ECREEE is the Centre for Renewable Energy and Energy Efficiency of the Economic Community of West African States (ECOWAS) based in Praia, Cape Verde. The institution was established by Regulation C / REG. 23/11/08 of the 61st session of the Council of Ministers of ECOWAS with a public mandate to promote regional markets for renewable energy and energy efficiency. It carries out its operations since 2010 with the support of the Governments of Austria and Spain and technical assistance from the United Nations Industrial Development Organization (UNIDO) among others. ECREEE is supported and enjoys the legitimacy of the Governments of Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo (i.e the 15 ECOWAS member states).

ECREEE has supported Ethe COWAS Member States in the development of their National SE4ALL Action Agendas, including the National Renewable Energies Action Plan (NREAP) and the National Energy Efficiency Action Plan (NEEAP). These documents provide an overview of the energy strategy and trajectories, they are validated by each Government and supported by national policies. Ultimately, the SE4ALL National Action Agenda translates national policies into a strategic path, enabling each country to meet SE4ALL targets by 2030.

Following the development of the SE4ALL Action Agenda, ECREEE, in collaboration with its partners, has developed a framework to assist ECOWAS Member States in the development of their respective SE4ALL investment prospectuses. The current phase for ECREEE, therefore, is to support Member States in developing their investment prospectus (IP) using an approach-based framework of developing a pipeline of effort and timetable projects to Each project identified at maturity and its "bankability".

ECREEE has received support from the European Union (EU) SE4ALL Technical Assistance Facility (TAF) to assist eight ECOWAS Member States in the preparation of their investment prospectus: Nigeria, Sierra Leone, Liberia, Cape Verde, Senegal, Togo, Benin and Côte d'Ivoire.

The SE4ALL Hub for Africa hosted by AfDB in consultation with its partners, has developed several guidelines to assist in the development of the country action program and the investment prospectus, a guide to assessing the quality of produced documents, guidelines for stakeholder consultation and a concept note on IP. The SE4ALL Hub Quality Circle evaluates the contents of the IP.

Specific SE4All actions in the country

About the SE4ALL Sustainable Energy for All initiative, Liberia conducted a Rapid Assessment exercise in 2013[19] with the support of UNDP. The Action Agenda, the NREAP and the NEEAP were developed in 2015.

2.4.2 SE4ALL – 2030 Vision and Objectives

Liberia as member state of ECOWAS subscribed and participated in the adoption of the ECOWAS policies on Energy Access, Renewable Energy, and Energy Efficiency (RE&EE) to be implemented at the national level, and represent Liberia's contribution to the achievement of the Sustainable Energy for All (SE4ALL) action agenda.

With as little as approximately 2% of the Liberian population having access to electricity and 86% of the population relying on wood, charcoal or other biomass to cook and heat their homes, a massive effort is needed to expand access to electricity and safe cooking fuels, especially in the rural and peri-urban areas identified as high-impact, offering the most potential to make rapid progress towards Sustainable Energy for All.

The SE4ALL Action Agenda has as one of its strategic goals for the government of Liberia (GOL) to use decentralized approaches to achieve energy access especially for rural populations since Liberia has been committed to the ECOWAS policies. The vision of the government is expressed by the Action Agenda, the NREAP, NEEAP and also

- The development objectives set by the Poverty Reduction Strategy (PRS), 2008, http://www.emansion.gov.lr/doc/Final%20PRS.pdf
- The National Agenda for Transformation (AfT), 2013 (http://allafrica.com/download/resource/main/main/idatcs/00080846:1b0f1d46c3e2c30c51658f7f64dcb7b9.pdf) objectives, and the National Energy Policy of Liberia (NEPL)
- The Achievement of the Millennium Development Goals (MDGs), 2008, 2010, (http://www.lr.undp.org/content/liberia/en/home/library/mdg.html) in Liberia and the goals set out in Liberia Rising 2030, 2013, Liberia's long-term vision of socio-economic development.

SUMMARY OF TARGETS

[19] http://www.se4all.org/sites/default/files/Liberia_RAGA_EN_Released.final_.pdf

Sustainable Energy for All is about driving actions and mobilizing commitments to positively transform the world's energy systems. The Secretary General's High-Level Group on Sustainable Energy for All has created a Global Action Agenda to guide efforts undertaken in support of achieving the initiative's three objectives:

- Ensure universal access to modern energy services;
- Double the global rate of improvement in energy efficiency; and
- Double the share of renewable energy in the global energy mix

To assist in the development of SE4ALL Action Agenda programs, the Global Action Agenda was developed as framework which contains 11 Action Areas. Using this framework, the Liberian government, public, private and donor institutions and stakeholders have created their own strategy towards Sustainable Energy for All through an inclusive, deliberative process.

ENERGY ACCESS

- 40% of Liberian citizens living in rural and peri-urban areas and using traditional biomass for cooking shall have access to improved stoves and kerosene or efficient-gas cookers in order to reduce indoor pollution
- 30% of the urban and peri-urban population shall have access to reliable modern energy services enabling them to meet their basic needs (lighting, cooking, communication, and small production-related activities);
- 15% of the rural population and 25% of the schools, clinics, and community centres in rural areas shall have access to modern energy services to meet the same basic needs. The long-term strategy is to make Liberia a carbon neutral country by 2050.

Share of population served by electricity services (%)	1.04	34.2	100
Share of rural population served by renewable energy and hybrid mini-grids (%)	0.05	8	44
Share of rural population served by standalone renewable energy systems (%)	0.15	15	35
Number of RE/hybrid mini-grids	6	75	150

RENEWABLE ENERGY

The Government of Liberia aims to take Measures to Accelerate Deployment of RE Technologies, i.e. solar PV, solar thermal including CSP, hydro- the major source and biomass including liquid fuels

- The Government of Liberia shall support research, resource assessments and potential pipeline development
- Specific policies and business models will be developed to support the pipelines and removal of barriers to development of large and small-scale renewable
- Due consideration shall be given to questions of affordability, availability, standards, and gender mainstreaming in energy sector

ENERGY EFFICIENCY

- Industrial and Agricultural Processes:
  - The industrial and agriculture sectors, as well as forestry operations, hold enormous opportunities for energy access, energy efficiency and renewable energy.
  - The Government of Liberia shall institute measures that include capture and recycling of waste heat, waste wood and other agricultural and industrial waste to be used for energy generation purposes
- Buildings and Appliances:
  - The Government shall introduce measures, actions and programs that include renewable self-generation options (e.g., rooftop solar and solar hot water).
  - Other Nexus impacts – including energy and health, water supply, agriculture applications, educational institutions, residences, tourism, etc.

- Transportation:
  - The application of RE in the Transportation sector is mainly focusing actions to improve and open up roads to increase transport efficiencies of vehicles and institute measures to insure, efficient and environmentally friendly vehicles on the roads of Liberia. The use of biofuels and solar energy in transportation shall be encouraged

Table 23: SE4All vision and objectives up to 2030

	2015	2020	2030
Target access rates to electricity (%) (*AA table 3*)			
• National	1,4	34,2%	100%
• Rural	-	34,5%	100%
Target access rate to butane as modern cooking fuel (%) (*AA table 15*)			
• National	10%	21%	43%
Target share of renewable in the generation capacity mix (%) (*from NREAP table 7*) ***(assuming that EE measures are taken (saving 1.605 GWH), and total generation equals 5694 GWh)***			
• Hydro	20,8% (*)	28,1% (*)	14,5 % (**)
• Non hydro renewable	0% (*)	14,8% (*)	8,0% (**)
• Fossil fuel	79,2% (*)	57,1% (*)	77,5% (**)
Target energy efficiency rates over 2013 baseline (%) (*from NEEAP table 3, 5, 6*)			
Electricity grid			
Total of losses in the power system, including technical and non-technical losses, in both transmission and distribution (% of power available: generation + balance of imports and exports),	28%	18%	10%
Buildings			
Target Energy Savings in the building sector after implementing EE measures, compared to non-EE Baseline	0%	4,7%	14,1%
Industry			
Percentage of industries that implement energy efficiency measures (%)	N/A	N/A	N/A
Percentage of energy saving in industry (%)	0%	5%	15%
Households			
Share of Population Using Improved Cook-Stoves in %	15%	26%	48%
Share of households using an alternative technology (%)	1%	2%	5%
Share of households using LPG (%)	10%	21%	43%
No. of residential houses with solar thermal systems (000) (*)	0	17,4	52,9
**Source: National SE4Focal Point / EU TAF Expert team / ECREEE*			
Comments *(*) table 15 AA*			

2.4.3 AA Roll-out and Implementation Actions

As noted earlier in this report, Liberia was faced with two daunting challenges: to recuperate war-ravaged generation, transmission, and distribution infrastructure and to massively expand that system to meet its ambitious SE4ALL goals. The government's post-war (re-)electrification strategy is now in its 3rd phase: rehabilitating the Mt. Coffee hydropower plant, due to reach 88MW of functioning capacity in July 2017; completion of three transmission corridors, to Kakata, Virginia and Klay, and to the Roberts International Airport; and Regional Transmission and Distribution Projects. The latter includes a rural electrification program based on the cross-border transmission line from Cote d'Ivoire, the RREA Master Plan, the Cote d'Ivoire, Liberia, Sierra Leone and Guinea (CLSG) interconnection project and the rural electrification component of the CLSG Project. In parallel, the country has undertaken to reform the electricity sector through unbundling of functions and development of a new institutional and regulatory framework.

The EU has supported the development of a Rural Energy Strategy and Master Plan for Liberia until 2030 for the Renewable and Rural Energy Agency (RREA), an independent agency of the Government of Liberia, established in 2010, that embodies the commitment to energy access and use of indigenous resources that are the cornerstones of Liberia's Agenda for Transformation and post-

Ebola recovery strategy which align closely with SE4ALL goals. In the longer term, many of the mini-grids to be established under the RREA Master Plan are intended to be connected to the national grid.

While endorsing the long-term importance of the private sector to the achievement of electrification and energisation goals, GoL officials have made it clear that in the near term, RREA will act as the main developer for generation, transmission, and distribution projects. This decision was based on the urgency of resolving problems in the sector, the lack of private sector players capable of engagement at the scale and in the time frame required, and the need for blending grant and commercial funds to achieve affordable electricity tariffs.

The first significant private sector involvement is foreseen to be as contractors to operate and maintain government-owned mini-grids. EUD-Liberia, USAID, and the World Bank have all undertaken pilot programs to establish mini-grids and are actively collaborating with RREA to define an approach for attracting private concessionaires to operate the mini-grids: through setting tariffs, operational and service requirements. In the absence of a regulator, this is proving to be a challenge.

SE4ALL, then, has an important role going forward to support the government in the execution of its Rural Energy Strategy and Master Plan, particularly in supporting resource mobilization for identified projects, while at the same time, promoting the development and inclusion of private participants in the sector.

Table 24: Action Agenda to reach SE4ALL Goals

No.	Action	Action description
1,1	Population served with electricity	Rural Electrification Plan – the RREA shall complete and publish the development of the national rural electrification plan
1,2		Undertake Sub-Sector Strategy- capacity training and resources assessments including solar, wind and mini-hydro training and resources assessments.
		Revise and update the existing plans – including updating the NEPL including cabinet adoption and incorporation of the measures and actions from the NREAP, NEEAP and SE4ALL as well as other relevant polices of the GOL plan
		The GOL shall make available a budget for the required funding for the Additional Plans/Studies needed to put the NREAP-NEEAP-SE4ALL action plans in action.
2,1	Cooking energy	Development of improved and market driven cooking stoves with local manufacturing opportunities
2,2		Ensuring that there is available investments with financial & social return
2,3		
2,4		Involvement of the poor in the creation and engagement of businesses for improved modern cooking technologies, including their involvement in Co-creating the business that engage with the poor.
2,5		Other priorities (including demand side management initiatives), such as efficiency improvements, and use of alternatives will be pursued.
3,1		
3,2		
4,1	Energy efficiency	National building code tailored to local conditions and construction practices, which requires or encourages minimum energy efficiency standards in buildings, criteria of tropical architecture and a link to urban planning, in line with the requirements of the ECOWAS Directive on Energy Efficiency in Buildings (EDEEB).
4,2		Measures aiming at reducing energy consumption in public buildings by addressing the building as such, efficient lighting and the building operation (including user behavior)

No.	Action	Action description
4,3		Qualification, accreditation and certification schemes for installers of energy–related building elements.
4,4		Develop and disseminate a compilation of model designs for sustainable construction of small buildings

2.4.4 Stakeholders, Programmes and SE4ALL Objectives

Table 25: Stakeholders, programmes and time frame

2.4.5 Financial Sources for the SE4ALL Initiative

Table 26: Multilateral Donors

Multilateral Donors	
Name	**Sponsor**
Adaptation Fund	United Nations Framework Convention on Climate Change
African Development Bank (AfDB)	
African Development Fund (ADF)	AfDB
Alliance for Rural Electrification (ARE)	
Climate Investment Funds	
EU Energy Initiative - Partnership Dialogue Facility (EUEI PDF)	EU
Global Bioenergy Partnership (GBEP)	
Directorate-General for International Cooperation and Development (DEVCO)	EU
Global Environment Facility (GEF)	
Global Green Growth Institute (GGGI)	
International Investment Bank (IIB)	
International Renewable Energy Agency (IRENA)	
The Nordic Development Fund (NDF)	
Organization for Economic Co-operation and Development (OECD)	
The OPEC Fund for International Development (OFID)	OECD
The Renewable Energy and Energy Efficiency Partnership (REEEP)	
United Nations Development Program (UNDP)	United Nations (UN)
United Nations Economic Commission for Africa's (ECA)	United Nations (UN)
The United Nations Environment Program (UNEP)	United Nations (UN)
United Nations Industrial Development Organization (UNIDO)	United Nations (UN)
The International Bank for Reconstruction and Development (IBRD)	World Bank
The International Development Association (IDA)	World Bank
The International Finance Corporation (IFC)	World Bank
The Multilateral Investment Guarantee Agency (MIGA)	World Bank

Bilateral Donors	
AusAid	Australia
Austrian Development Cooperation (ADC)	Austria
Department of Foreign Affairs, Trade and Development	Canada
DANIDA	Denmark
IFU	Denmark
Global.finland	Finland
Agence Française de Développement (AFD)	France
French Facility for Global Environment (FFEM)	France
The Federal Ministry for Economic Cooperation and Development (BMZ)	Germany
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	Germany
Kreditanstalt fur Wiederaufbau (KfW)	Germany
Irish AID	Ireland
Japan International Cooperation Agency (JICA)	Japan
Lux-Development	Luxembourg
The New Zealand Aid Program (NZAID)	New Zealand
Norwegian Agency for Development Cooperation. (NORAD)	Norway
Spanish Agency for International Cooperation for Development (AECID)	Spain
Swiss Agency for Development and Cooperation (SDC)	Switzerland
Department for International Development (DFID)	United Kingdom
International Climate Fund	United Kingdom
USAID	United States
US Trade and Development Agency (USTDA)	United States

2.4.5.1 Committed Financing Resources

The Rural Energy Strategy and Master Plan for Liberia Until 2030 indicates, on a project-by-project basis what funds have been committed. USD 935M investments for rural electrification are foreseen. The table below shows a summary of the Rural Energy Master Plan investments per Program and type of investment (Generation, High Voltage Transmission, Distribution and other), as well as committed investments and the funding gap.

Table 27: RE Energy Strategy & Master Plan funding needs and Gaps[20]

Program	People	MW	Total Cost (M €)	Committed funds (M €)	Funding Gap (M €)
Growing the Grid	831.000	100	552	81	**471**
Decentralized Grid	489.100	62,5	291,9	60	**232**
Beyond the Grid	18.900	3,5	16	0	**16**
Other than Power	0	0	24,3	0	**24**
Capacity Building	0	0	52	0	**52**
	1.339.000	**166**	**936,2**	**141**	**795,2**

[20] Table derived from RREA Master Plan, Annex 1

2.4.5.2 Potential Financing Resources

Low electricity access in rural areas has been addressed in the Rural Energy Strategy and Master Plan (RESMP) adopted in August 2016 by the GoL. The initial focus is on the main cities and towns outside Monrovia where there is business activity and some capacity to pay for energy services, with the objective to reach 35% of the population outside of Monrovia by 2030, to provide electricity to all county capitals, health facility and secondary schools (by 2025). More than 75% of all electricity generated should come from renewable sources by 2030.

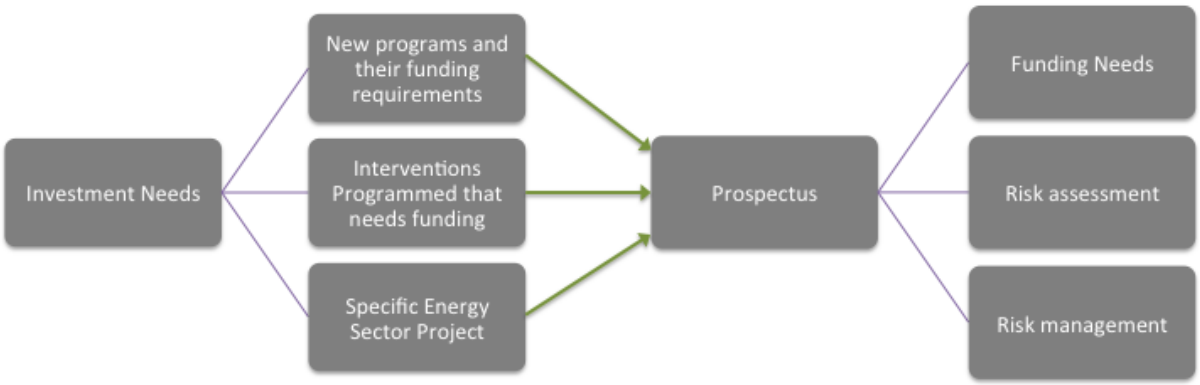
From the required USD 935 Million to implement the RESMP, around USD 140.8 Million are already committed and an additional USD 45 Million obtained, representing a total of USD 185 Million - mostly from the African Development Bank (AfDB), the World Bank (WB) and the European Union (EU). Most of these funds will be disbursed in 2016-2020.

2.5 IP Framework

2.5.1 Linkage between AA and IP

Liberia developed and approved the SE4All Action Agenda, the National Renewable Energy Action Plan and the National Energy Efficiency Action Plan. These documents define the national strategy regarding the energy sector, following a sustainable path and aligned with the SE4All goals.
Following these previous documents, the IP consists of the development of a pipeline of projects to be presented to potential investors, such as public and private financing institutions.
A schematic overview of the Investment Prospectus development process is provided in Figure 4 below.

Figure 4: Development process of the Investment Prospectus



- Programme Support, TA for Government or SE4ALL Secretariat to carry out the implementation of the AA,
- Project Investment Opportunities Associated to Specific Government Agency or parastatal, i.e., rural electricity agency, national utility.
- Project Investment Opportunities Associated to NGOs and CSOs
- Project Investment Opportunities PPPs

2.5.2 IP Portfolio Management

On the government side, the management of the Rural Energy Strategy and Master Plan for Liberia until 2030 will also provide management for the overlapping SE4ALL. On the private side, SE4ALL will need to arrange for a national consultant or other entity to manage the portfolio. There is a task specified under Enabling Environment to do just this.

2.5.3 Implementation Arrangements

As previously noted, the alignment between SE4ALL and the Rural Energy Strategy and Master Plan for Liberia Until 2030 means that the implementation plan of the rural energy strategy and master plan will, *de facto*, be the implementation plan for SE4ALL.

2.5.4 Monitoring and Evaluation

As the Rural Energy Strategy and Master Plan (RESMP) for Liberia Until 2030 describes a framework of actions for Monitoring, Evaluation and Control (M&E)[21] and since SE4ALL aligns with RESMP to a large extent, such M&E functions can be shared between RESP and the IP functioning.

2.6 SE4All – Enabling Environment

The Government of Liberia has already included in the Electricity Law some enabling environment measures and initiatives that reinforce its commitment in achieving the proposed SE4All goals, concerning on-grid generation, transmission and distribution. Definite implementation of such measures and initiatives is yet to be defined.

2.6.1 On-grid (Generation, Transmission, and Distribution)

Table 28: On-grid (Generation, Transmission, and Distribution) - Institutional framework

Measures	Value – Assessment - Statement
Grid connected RE electricity generation	
Create standardized procedures for authorization of RE plants, including grid connected and off grid ones	2016 -…
Set up clear legislation that defines the procedure for granting permission to connect RE production plants to the public network)	2016 onwards
Ensure coordination between grid infrastructure approval and other administrative procedures	2016-2030
The NREAP re-affirms the 2015 Electricity Law of Liberia, which creates an Independent Liberia Electricity Regulatory Commission (LERC; “Regulator”) and empowers it to enforce the improvement of the efficiency of the system and compliance with established benchmarks, procedures and standards	2016 -…
Create the regulations to the Electricity Law and Strategy to:	2016 -…
Highlight how the utility will achieve the RE targets in the electricity supply mix (it should clearly highlight the roles of IPPs in the achievement of its targets)	2016 - 2030
Identify the process for IPPs to request licenses to the utility for grid connection	2016-2030

[21] http://liberiaruralenergy.org/?q=content/monitoring-and-control

Develop a grid extension plan that considers the integration of RE and the improvement of electricity security.	2016 - 2030
Introduce legal and regulatory framework for hydropower including environmental protection standards and coordinated use of water resources	2016-2020
Provide an incentive package such as tax holidays for IPPs of specified capacities, duty exemption on RE equipment for licensed IPPs for a specified period of the license, to directly stimulate RE deployment	2017 and five (5) years on
Implement a mechanism to set prices for IPPs	2016 - 2030
Financial Support for Investment in RE: this includes implementation of pilot projects, provision of financial support mechanisms (loans guarantees, grants, tax incentives, etc.)	2016 - 2030
Innovative financing schemes for small RES plants (e.g. solar home systems)	2016 - 2030
Promote photovoltaic (PV) & solar thermal market and entrepreneurs	2016 - 2030
Source: *National SE4Focal Point / EU TAF Expert team / ECREEE*	

In the short-to-medium term, on-grid development is focused on restoring the operation of fossil-fuelled plants. In addition on the on-grid generation front, rehabilitation of the Mount Coffee Hydro .project is taking place, expected to be fully operational by the end of 2017,

Table 29: On-grid (Generation, Transmission, and Distribution) - Ongoing Projects / Initiatives

Name of Project / Initiative	Institution	Time horizon
TBD		
Source: *National SE4Focal Point / EU TAF Expert team / ECREEE*		

2.6.2 Off-grid (Mini-grids and Standalone Systems)

Mini-grid development has been planned, in detail, in Rural Energy Strategy and Master Plan for Liberia Until 2030.

Table 30: Off-grid (Mini-grids and Standalone Systems) - Institutional framework

Measure	Value – Assessment - Statement
Create mobilization of environmental funds for power sector. This will include the REFUND created in the RREA Act, funding from mining, agricultural and other concessions under the Social Development funds that could be allocated for power development.	2017-onwards
Build capacity of the different actors involved in the authorization, certification and licensing activities on	2016 onwards

the procedures and standards to be applied,	
Set up a capacity building program of IPPs and the staff of the energy ministry in the field of RE	2016 -- onwards
Systematic inclusion of RE and EE topics in school curriculum	2016 - 2030
Set up and implement Capacity Building and Awareness Raising programs for mini-grids	2016-2030
Capacity building off-grid management and system operations and maintenance for sustainability	2016 - 2030
Mandate that all off-grid RE installations need to be deployed by certified installers	2016 - 2030
Develop a database that identify certified installers for Off-Grid RE with requirements for local content and empowerment of locals	2016 - 2030
Ensure coordination/cooperation between the different actors involved in the authorization, certification and licensing activities	2016 - onwards
Create a one-stop-shop for coordinating all steps in the permission process. Create procedures to facilitate horizontal coordination between different administrative bodies responsible for the different parts of power generation permission	2016 -- onwards
Create a program linked with the ECOWAS Bio-energy Program to promote: implementation of plantation and woodlot projects to supplement wood requirements of the populations for both construction industry and for cooking	2017-2930
Source: *National SE4Focal Point / EU TAF Expert team / ECREEE*	

Table 31: Off-grid (Mini-grids and Standalone Systems) - Projects / Initiatives

Name of Project / Initiative	Institution	Time horizon
Wozi mini hydro	RREA	
Ya Mini Hydro	RREA	
Bopolu micro Hydro	RREA	
Robertsport micro Hydro	RREA	
Concessionaire/operator for LIRENAP Mini-grid	RREA/WB	2018
Mini-grid and concessionaire for Southeast of Liberia	RREA/EU	2019
Expansion of Firestone generation and micro-grid	Firestone Company	
Mein Creek (Kpatawee) Mini-hydro	RREA?	
St. John River	RREA?	
Lofa mini-hydro feasibility assessments	RREA?	
ECREEE's SSHP projects feasibility	RREA	
Lighting Lives in Liberia – commercialization of solar lighting products in Liberia	TBD	
Scaling-Up Renewable Energy Programs (SREP)	TBD	
USAID-proposed Beyond the Grid (BTG) Project to Support SREP Program Implementation	TBD	
Source: *National SE4Focal Point / EU TAF Expert team / ECREEE*		

2.6.3 Bioenergy and Efficient Cook-stoves

Table 32: Bioenergy and Improved Cook-stoves - Institutional framework

Measure	Value – Assessment - Statement
Provide an incentive package to directly stimulate off-grade RE deployment for modern cooking fuels and technologies	2016 - 2030
Training of commercial users on improved fuels and cook-stove maintenance and operations	2016 - 2030
Create a program linked with the ECOWAS Bio-energy Program to promote: implementation of plantation and woodlot projects to supplement wood requirements of the populations for both construction industry and for cooking	2017-2930
Institutional support structure	TBD
Promotion programmes	TBD
Incentive programmes	TBD
Source: *National SE4Focal Point / EU TAF Expert team / ECREEE*	

Bioenergy and Improved Cook-stoves is one area where there are nascent private sector initiatives/operators.

Table 33: Bioenergy and Improved Cook-stoves - Ongoing Projects / Initiatives

Name of Project / Initiative	Institution	Time horizon
Production of clean charcoal	J-Palm Liberia	
HFV biomass to Energy	HFV Ltd	
Source: *National SE4Focal Point / EU TAF Expert team / ECREEE*		

2.6.4 Energy Efficiency

While planning efforts thus far have focused on the building sector, high impact opportunities for promoting energy efficiency exist in the water authority and the cement plant.

Table 34: Energy Efficiency - Institutional framework of the energy sector

Measure	Value – Assessment - Statement
Conduct diagnostic studies to determine power losses and key mitigation actions	2016-2020
Continuously monitor and create regulations to ensure adequate inventory levels to cushion any short-term disruption in electricity supply	2016 -…
Improve and maintain accurate metering and billing systems for electricity	2016 -…
Support research in renewable energy and provide financing for pilot demonstration projects	2016- 2030
Establish procedures and conditions for installers to get the Certificate for installation of RE, including solar thermal systems, as well as conditions for the equivalency of training courses	2016 - 2030
Create official guidance for local and administrative general service agency (GSA) planning, designing, building and refurbishing industrial and city areas to make provision for equipment and systems that use RE in electricity and water heating	2016 -…
Define national qualification schemes and standards for installers of RE equipment and the quality & standards of equipment	Planned
Establishment of Energy efficiency agency	None
EE promotion programmes	None
EE investment incentives	None
Source: *National SE4Focal Point / EU TAF Expert team / ECREEE*	

Table 35: Energy Efficiency - List of Ongoing Projects / Initiatives

Name of Project / Initiative	Institution	Time horizon
Installation of Variable Speed Drive motors (VSDs) for pumping	Liberia Water and Sewer Corporation	TBD
Source: *National SE4Focal Point / EU TAF Expert team / ECREEE*		

2.6.5 Enabling Environment

Table 36: Enabling Environment - Institutional framework

Measure	Value – Assessment - Statement
Develop and implement a policy framework for the use and supply or biomass in the country.	2016 -…
Ensure harmonization of bio-fuels as well as other RE development and investment policies and strategies with other sector policies and strategies at the national level as well as with the regional bio-fuels strategy	2016 -…
Identify the national authority/body that is responsible for monitoring the compliance of the bio-fuels with sustainability criteria and for certification of bio-fuels	2016 -…
Provide information on available land areas that can be used to produce bio-fuels	2017 -…
Promote the use of the biomass from agricultural and forestry/logging waste and invasive plant species to be used as a RE source of energy in articulation with the ECOWAS bio-energy program	2016-2030
Implement demonstration projects to show how to use agro-industry, forest logging and sawmills residues to produce energy	2016-2030
Improving the efficiency and sustainability of the energy value chain through participatory and sustainable forest management (PSFM)	2016 - 2030
Promote the use of RES technologies in the water supply infrastructure and in the agro-food sector	2016 - 2030
Provide incentives for the utilization of national bio-fuels	2016 -…
Promote biodiesel and ethanol substitution in transport sector	2016 - 2030

Source: National SE4Focal Point / EU TAF Expert team / ECREEE

Table 37: Enabling Environment - Projects / Initiatives

Name of Project / Initiative	Institution	Time horizon
Support of SE4ALL AA and IP Implementation	SE4ALL Focal Point	Immediate

Source: National SE4Focal Point / EU TAF Expert team / ECREEE

3 PIPELINE OF SE4ALL PROJECTS

3.1 IP Pipeline

3.1.1 Time Horizon

The development of Liberia's electricity generation, transmission and distribution infrastructure requires careful planning and phasing. The model which is being followed includes mainly three distinct phases.

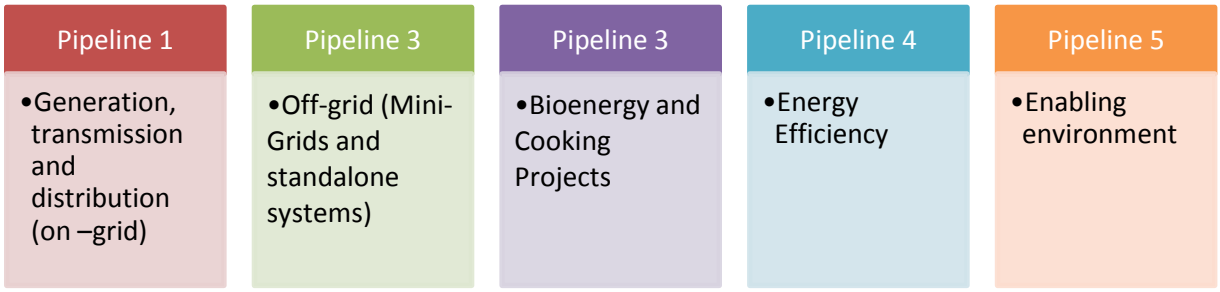
- Development of main Transmission Network including Monrovia's distribution infrastructures and also cross-border lines for electrification of close to the border areas, in parallel with the development of Power generation infrastructures
- Development of mini-grids across the country, utilizing both Renewable Energy and Fossil Fuels
- Gradual Interconnection of mini-grids with the main Network.

Table 38: **Investment Prospectus – Time Line**

Short Term	Medium Term	Longer term
Projects to be implemented between 2016 - 2020	Projects to be implemented between 2021 -2025	Projects to be implemented between 2026-2030

3.1.2 SE4All IP Pipelines

Figure 5: Five ECOWAS SE4All IP Pipelines



Source: ECREEE IP Flyer – Annex 1

Table 39: **Investment Prospectus – ECOWAS SE4All IP Pipelines**

No,	Pipeline	Definition
1	On-Grid (Generation, Transmission and Distribution)	TBD. It should be noted, however, that there is some fluidity between Pipelines 1 and 2, inasmuch as mini-grids are being built to grid specifications to accommodate eventual connection to the grid. Likewise, the issues to be addressed by the currently four distribution companies will not differ significantly from the mini-grids.
2	Off-grid (Mini-Grids and Standalone Systems)	
3	Bioenergy and Cooking Projects or programs	
4	Energy Efficiency	
5	Enabling Environment	
Source:	*National SE4Focal Point / EU TAF Expert team / ECREEE*	

3.1.3 Eligibility Criteria

3.1.3.1 General IP Criteria

- Project alignment with AA: contribution to the SE4ALL objectives in terms of increased access to electricity, increased access to sustainable modern cooking fuels, use of renewable energy, increased energy efficiency;
- Alignment with relevant national plans (Master Plan, etc.);
- Probability of implementation;
- Sustainability;
- Scalability/easy replication,
- Project timeline,
- Social inclusion (number of Beneficiaries, gender approach, poverty alleviation…),

3.1.3.2 Specific Country IP Criteria

- P1
  - Respect of the RREA Master Plan and the main orientations of the country
- P2
  - Respect the RREA Master Plan and the main orientations of the country
  - No exclusion of the future means of production linked to the grid
  - Management model: private operator (electricity code)
  - Autonomous Individual Systems: penetration capacity and diffusion rate / simple replication
- P3
  - Proved penetration capacity and diffusion rates
  - Demonstration existence
  - Valorisation of the residue not the agricultural resource
  - No competition with food use
- P4
  - 20% of gains relative to the reference scenario (« baseline ») during the investment period
  - Part of a pragmatic approach for tertiary buildings (large size)
- P5
  - Alignment to the priorities of the SE4ALL Action Agenda, prevision or planning of regulatory framework/s

7

3.2 Projects

The projects are classified as projects with project fiches (table 40) and initiatives of interest (table 41). Project fiches are to be found in annex 5.

Table 40: **List of short term projects (before 2020) with projects fiches**

IP Code	Name of the Project	Name of Sponsor	Total Project Costs (Euros)	Investment Needs (Amount/Percentage)	Nature of investment need
Pipeline 2 - Off-grid (Mini-Grids and Standalone Systems)					
LI_P2_1	Wozi mini hydro	RREA	8,78M	TBD	Equity/Debt/Grant
LI_P2_2	Bopolu micro Hydro	RREA	2,23M	TBD	Equity/Debt/Grant
LI_P2_3	Robertsport micro Hydro	RREA	0,92M	TBD	Equity/Debt/Grant
LI_P2_4	Gbedin Falls Small Hydro	RREA	27M	TBD	Equity/Debt/Grant
LI_P2_5	Ya Creek Small Hydro	RREA	16M	TBD	Equity/Debt/Grant
LI_P2_6	River Gee Small Hydro	RREA	11M	TBD	Equity/Debt/Grant
LI_P2_7	Small Scale biomass to Energy Projects	RREA	1,7M	TBD	Equity/Debt/Grant
Pipeline 5 - Enabling Environment					
LI_P5_1	Development of draft legislation and regulations for import tariff exemption for Renewable energy products	Ministry of Mines, Land, and Energy, Department of Energy	115.000	115.000; 100%	Grant
LI_P5_2	Capacity Building Program	Ministry of Land, Mines (MLME), and Energy, Rural and Renewable Energy Agency (RREA), Liberia Electric Corporation (LEC)	2 M	2 M; 100%	Grant

Table 41: Initiatives of interest

Name of the Project	Name of Sponsor	Comment
Pipeline 1 - On-grid (Generation, Transmission and Distribution)		
Expansion of Firestone Hydropower plant - 4 MW	Firestone Plantations Co.	Initially auto-production, later connection to Grid.
Gigawatt Global; PV projects	Gigawatt Global Cooperatief U.A.	PV projects in the interconnected system. Announcements have been made in the press.
Pipeline 2 – Off grid		
Roberts Airport Solar/Hydro Mini-grid	International Investor (With Option for Local Company Partnership(s)	Solar /Hybrid Feasibility Study
Pipeline 3 - Bioenergy and Cooking Projects or Programs		
Production of clean Charcoal	J-Palm Liberia	J-Palm Liberia, producing J-palm oil considers entering into the efficient charcoal market
Biomass to Energy	HFV Ltd	HFV (http://hf-v.net/energy/) is developing a biomass to Energy Project, but no further information was forthcoming from the company
Pipeline 4 - Energy Efficiency		
Installation of Variable speed drive motors (VSDs) for Water pumping	Liberia Water and Sewer Corporation	Feasibility study required.

4 ANNEXES

4.1 Annex 1: Schedule of meetings

Date	Institution
15/3/2017	Jacob Sandikie
15/3/2017	NRECA
16/3/2017	Roundtable meeting for Lofa concession
16/3/2017	RREA
17/3/2017	EUD
17/3/2017	NRECA
17/3/2017	GIZ
17/3/2017	RREA
18/3/2017	Jacob Sandikie
20/3/2017	MLME
20/3/2017	MLME
21/3/2017	EUD
22/3/2017	J-Palm Liberia

4.2 Annex 2 : Persons met

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4.3 Annex 3: Documents consulted by the TAF

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- Republic of Liberia Intended Nationally Determined Contributions (INDC), 2015. http://www4.unfccc.int/submissions/INDC/Published Documents/Liberia/1/INDC Final Submission Sept 30 2015.002.pdf
- UNDP in Liberia. http://www.lr.undp.org/content/liberia/en/home/library/mdg.html

4.4 Annex 4: Assumptions used FOR THE SCENARIOS NREAP-NEEAP-SE4ALL

Appendix III Gives the Calculation Parameters for the Scenarios for NREAP-NEEAP-SE4ALL, Calculation Parameters for the Scenarios NREAP - NEEAP -SE4ALL		
	Value	
Base year	2010	To be chosen by the national team, on the basis of availability of data
Beginning of execution of national plans	2016	Year in which the execution of the NREAP, NEEAP and SE4ALL plans will start
General parameters (data for the base year)		
Country: Liberia	Liberia	
Population	3,630,030	
Population growth rate	2,0%	
Family size	5	Number of people per housing unit
National currency (Liberian Dollar)	LD$	
Exchange rate (LD$/US$1)	80	= value euro/value national currency
GDP (000 000)	1,946	in millions, of national currency
Annual economic growth rate	5,5%	in %
National discount rate	10,0%	This is equivalent to the interest rate used to calculate the profitability of investments, It is used in this tool to calculate net present values of energy investments, If no national value is available (for instance from the Ministry of Economy), use a suggested value =10%)
Parameters and objectives for the power sector		
Installed generation capacity (MW)	65	It would be preferable to exclude capacity that has been out of service for a long period of time, for instance > 2 years
Annual electricity generation (GWh)	190	
Growth rate of electricity generation	17,1%	
Electricity tariff (Liberian Dollar/per kWh)	43,20	
Expenses for purchase of fossil fuels, as percentage of total power sector costs	50,0%	Expenditures on fossil fuels for thermal electricity generation, divided by the total value of sales of electricity from thermal sources
GHG intensity of the electricity sector (kg/MWh)	400	Average Greenhouse Gas (GHG) emissions of the electricity sector, in kg CO2 equivalent per MWh electricity produced
Parameters and objectives for rural electrification and access to electricity		
Rate of access to electricity (base year)	1,4%	
Target year to reach universal access	2030	According to national objectives and plans, including the national SE4ALL Action Agenda
% of grid connections	60,0%	Percentage of households connected to the national grid (acc, to national plans and objectives); this does not include user that will receive service from mini-grids or stand-alone systems

Cost of grid connection (Liberian Dollar)	24,000	Average costs of connecting a new user to the grid (including costs borne by the utility and costs borne by the user)
Cost of off-grid service (Liberian Dollar)	24,000	Average costs per user of mini-grids or stand-alone systems
Economic impact of access to electricity (Liberian Dollar)	4,800	Increase in GDP attributable to each new household receiving access to electricity (both grid connected and off-grid solutions)
Parameters and objectives for the use of renewable energy in the power sector		
PV generation (in the base year) (GWh)	0	
Technical and economic potential for new PV generation (MW)	253	Taking into account all local conditions (favorable/unfavorable): cost of alternative fossil based technologies; willingness and ability to pay of users; local technical capacity; availability of public and private capital, etc.
Number of operating hours of PV per year (Hours)	1,800	Number of hours of generation/year; calculated as an equivalent to the numbers of hours at full capacity generation
Investment cost per kW PV (Liberian Dollar)	200,000	
Average annual operating costs per MW of installed PV capacity (Liberian Dollar)	2,332,800	
Wind generation (base year) (GWh)	0	
Technical and economic potential for new wind generation (MW)	0	same as PV
Number of operating hours of wind per year (hours)	2,500	same as PV
Investment cost per kW wind (Liberian Dollar)	160,000	
Average annual operating costs per MW of installed wind capacity (Liberian Dollar)	6,480,000	
Hydropower generation (base year) (GWh)	40	
Technical and economic potential for new hydropower generation (MW)	175	same as PV
Number of operating hours of hydropower per year (hours)	4,500	same as PV
Investment cost per MW of hydropower (Liberian Dollar)	240,000	
Average annual operating costs per MW of installed hydropower capacity (Liberian Dollar)	3,888,000	
Year to realise the full RES potential	2025	According to national plans and objectives, year in which the combined planned new RES investments will be operational
Parameters and objectives for energy efficiency in the power grid		
Rate of grid losses (base year)	28,0%	Technical and non-technical losses in electricity transmission and distribution
Year in which losses will be reduced to 10%	2025	According to applicable power sector plans and the NEEAP; as defined in the NEEAP, the year in which the losses of the electric grid will be reduced to 10% of electricity

		generation
Capital intensity of grid EE investments (Liberian Dollar)	80,000	Value of investment (hard, soft, institutional) needed to reduce losses by 1 MWh/year, expressed in the national currency
Parameters and objectives for EE in grid connected domestic lighting		
Number of lights per grid connected household	9	= national average
Power rating of incandescent lamps (W)	60	= national average
Year to attain 100% high efficiency lighting	2018	Year in which all incandescent lamps shall be replaced by high efficiency lamps (CFL, LED, etc,); the period for execution of the "EE lighting plan" should be less than the average lifetime of high efficiency lamps
Cost of one low consumption lamp (LCL) (Liberian Dollar)	160	Average cost, including all types of high efficiency lamps
Lifetime of LCL (years)	4	Average lifetime, including all types of high efficiency lamps
Verification of the length of the plan	Plan OK	Automatic verification, carried out by the tool!
Number of use hours/year/lamp (hours)	1,200	= national average
Estimated total national power consumption for household lights (GWh)	7	Automatic calculation based on the parameters above, This should amount to approx, 50% of total national power use for all types of lighting (see automatic verification below)
National total power consumption for lighting (independent data) (GWh)	22	Independent household data of all types, obtained e,g, from national power company, national statistics organization, etc,
Automatic verification of lighting data	Data OK	
Reduction of electricity consumption through the use of high efficiency lamps	60%	Estimated reduction in household power consumption through the implementation of a national program to disseminate high efficiency household lighting
Parameters and objectives for EE off-grid lighting		
Number of off-grid lights per household	3	= national average, number of lights and lighting devices per family, including stand-alone solar lamps or high-efficiency lamps powered by a decentralized or stand-alone source (solar PV, pico-hydro, mini-grids, etc,)
Fossil fuel consumption for lighting per family per year (kg)	30	Average consumption per household of fossil fuels - such as kerosene, oil, etc, - for lighting and other energetic uses
Price of kerosene (per liter) (Liberian Dollar)	120	
Cost of an off-grid lighting device (Liberian Dollar)	1,600	National average cost of off-grid lighting devices for all types of technologies: stand-alone solar lamps, the lighting portion of a solar home system etc,

Lifetime of an off-grid lighting device (years)	3	
Parameters and objectives for EE in buildings		
Percentage of national electricity consumption in buildings (in base year)	40%	For air conditioning, ventilation, water heating; this does not include lighting
Technical and economic potential for EE measures in buildings	15%	Percentage reduction in electricity consumption in buildings, with a payback time acceptable for building owners and users (see below)
Year to achieve 100% of the potential savings in buildings	2031	
Simple payback time for EE measures in buildings acceptable to building owners and users (years)	5	Number of years necessary for the energy savings to pay for EE measures
Parameters and objectives for EE in industry		
Percentage of national electricity consumption in industry (in base year)	20%	Includes all industrial activities (transformation of matter), including artisanal activities, treatment of minerals, agro-industrial activities, etc,
Technical and economic potential for EE measures in industry	15%	Percentage reduction in electricity consumption in industry, with an acceptable payback time
Year to achieve 100% of the potential savings in industry	2029	
Simple payback time for the EE measures acceptable to industrial enterprises (years)	3	Number of years necessary for the energy savings to pay for EE measures
Parameters and objectives for EE in public lighting		
Percentage of national electricity consumption for public street lighting (in base year)	1%	
Technical and economic potential for EE measures in public street lighting	20%	Percentage reduction in electricity consumption for public street lighting with an acceptable payback time (see below)
Year to achieve 100% of the potential savings for public street lighting	2024	
Simple payback time for the EE measures acceptable to municipalities/street light operators (years)	4	Number of years necessary for the energy savings to pay for EE measures
Parameters and objectives for cooking		
Year to reach 100% of households with access to clean, affordable, safe and sustainable cooking	2031	
Percentage of families using LPG for cooking (base year)	10%	
Cost per family of equipment for LPG cooking (Liberian Dollar)	100	Average cost per family for all types of equipment: individual (bottle/tank, cooking appliance/hot plate); collective (filling station, distribution network, tanks, etc,)
Lifetime of LPG cooking equipment (years)	10	Average lifetime of the different types of equipment

Target for the percentage of families using LPG, when the 100% access to modern cooking target is achieved	45%	
Percentage of families using improved stoves (wood, charcoal) for cooking (in base year)	15%	
Cost per family for an improved wood/charcoal stove (Liberian Dollar)	10	
Lifetime of an improved cookstove (years)	10	
Target for the percentage of families using improved Cook-stoves, when the 100% access to modern cooking target is achieved	50%	
Percentage of families using an alternative modern cooking technology (in base year)	1%	Modern cooking technologies include: biogas, ethonal, pellets, solar stoves, etc,
Cost per family of alternative modern cooking technology (Liberian Dollar)	50	
Lifetime of alternative cooking technology	10	For all types of alternative technologies that are targeted in national plans
Target for percentage of families using alternative modern cooking technologies, when the 100% access to modern cooking target is attained	5%	
Automatic check of targets	Plan OK	Automatic verification: the sum of targets for LPG, improved stoves and alternative technologies = 100% (note: unless the national plans aim at a target lower than 100% within the scenario period)

4.5 Annex 5: Project Fiches

See separate document.