National Renewable Energy Action Plan (NREAP)

REPUBLIC OF SIERRA LEONE

Period [2015-2020/2030]

Within the implementation of the

ECOWAS Renewable Energy Policy (EREP)

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1 INTRODUCTION

The ECOWAS Renewable Energy Policy (EREP) and the ECOWAS Energy Efficiency Policy (EEEP) were adopted by the ECOWAS Member States in October 2012 and the ECOWAS Heads of States on 18 July 2013. The policy documents were prepared with technical support from the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) and a broad range of international partners (UNIDO, EUEI-PDF, GEF-SPWA, Austria, and Spain). The policies include minimum targets and scenarios for renewable energy (RE) and energy efficiency (EE) and measures, standards and incentives to be implemented at both regional and national levels.

The EREP foresees the development of National Renewable Energy Action Plans (NREAPs) by all fifteen ECOWAS Member States, by the end of 2014. The five-year rolling NREAPs will contribute to the achievement of the regional EREP targets by 2020 and 2030. The NREAPs have been prepared by the ECOWAS Member States in accordance with a template provided by ECREEE. The NREAPs include baseline data on the status of renewable energy development, and propose attainable and renewable energy targets, incl. gender disaggregated indicators, based on national potential and socio-economic assessments. Moreover, an overview of concrete laws, incentives and measures to be implemented by the country to achieve the targets has been included. The implementation of the NREAPs will be monitored by the Ministry of Energy and ECREEE on behalf of the ECOWAS Commission, during a continued consultative process. The NREAP template was prepared with technical assistance from ECREEE. The NREAP development process has been supported by a broad range of partners, such as UNIDO, the GEF within the Strategic Programme for West Africa, the European Union, AfDB, GIZ, IRENA, and the Governments of Austria and Spain.

2 SUMMARY OF NATIONAL RENEWABLE ENERGY POLICY

Sierra Leone is endowed with huge renewable energy potential which is grossly untapped and underutilized due to lack of government policy direction, lack of financial resources and inadequate research and development of renewable energy technologies. The high dependency on fossil fuel for electricity generation and transport is causing a huge burden on the national budget, coupled with climate change, other adverse environmental impacts and the effect of greenhouse gas emissions.

Consequently, it is essential that a coordinated, coherent and comprehensive National Renewable Energy Policy (NREP) be put in place to drive hydropower, bio-energy, solar and wind power as energy sources. The Renewable Energy Policy advanced in this document is intended to serve as a blueprint for the sustainable development, supply and utilization of energy resources within the economy for both grid and off-grid energy solutions.

Rural areas that are remote and have a low demand density will have to depend on off-grid energy solutions as the economies of grid deployment do not favour rural electrification. Off-grid areas will have to depend on alternative solutions. The implication of this strategy for improved energy supply across Sierra Leone will entail the utilization of renewable energy sources at our disposal, both on and off-grid.

The Sierra Leone energy policy adopted in 2009 and the Agenda for Prosperity (AfP, 2013) attempted to touch on renewable energy issues, however, they were limited in their scope to only mentioning general issues without giving the detailed framework required to make the difference. Furthermore, this NREAP will deal with the specific needs of the electricity sector in the context of the on-going electricity reforms and public private partnership (PPP) policies. It has therefore become necessary to have an integrated Renewable Energy Action Plan that addresses the important needs of the Sierra Leone electricity supply industry, backed up by an integrated resource plan.

In addition, Sierra Leone needs the National Renewable Energy Action Plan (NREAP) to achieve national policy objectives that are in line with the EREP (which was adopted by all 15 Member States, including Sierra Leone). Development partners are to support the Government in achieving its own objectives.

The NREP and NREAP objectives and implementation strategies have been carefully defined and aligned, with the fundamental guiding premises being that energy is crucial for achieving national development goals and that government has a prime role in meeting the energy challenges facing the nation. Therefore, this renewable energy action plan is designed to pave the way for detailed legislation, policies and regulations. Consequently the overall renewable energy **policy objectives** may be summarized as follows:

i. To ensure the development of the nation's energy resources, for national energy security and optimal energy resource mix;

ii. To guarantee adequate, reliable, affordable, equitable and sustainable supply of renewable energy in an environmentally friendly manner. To establish the process of acquisition and diffusion of technology, managerial expertise and indigenous participation in the renewable energy sector industry, for stability and self-reliance;

iii. To promote investments and development of the renewable energy sector, with substantial public private partnership (PPP) projects.

iv. To ensure integrated and well informed sources of renewable energy, with plans and programmes for effective development;

v. To successfully use the nation's abundant energy resources to promote international cooperation.

vi. To bring abundant electricity access to the population;

vii. To develop the nation's renewable energy resources through the establishment of appropriate financing mechanisms that support private investment in the subsector;

viii. To ensure effective coordination and collaboration among all players in renewable energy activities in Sierra Leone.

Socio-economics of the Policy

Since the end of the internal conflict in 2002, Sierra Leone has made significant progress in consolidating peace and security country-wide and in rebuilding its economy, which was nearly destroyed by the decade-long conflict. The country has successfully implemented two medium-term development strategies that invested in peace and state-building, mainly through consolidation and infrastructure enhancement and strengthening macroeconomic foundations by qualifying for debt relief under the Highly Indebt Poor Countries Initiative. The country is now classified as one of the world's top ten business reformers and is a net recipient of millions of dollars in foreign direct investment. However, poverty rates are still high despite a reduction between 2003 (66%) and 2011 (53%) (MoFED Bulletin, 2013).

Despite this notable progress, the underlying drivers of fragility continue to pose significant downside risks for the country's development. High rates of youth unemployment, which stands at 70% in the Human Development Index 2013, gender inequality, high levels of perceived and real corruption, weak human and institutional capacities and poor economic governance systems, especially public financial management (PFM) and revenue management systems, constrain the Government's capacity to implement its development agenda. Limited physical infrastructure, especially in energy, water supply and roads, inhibit inclusive and sustainable growth and limits the country's ability to implement its transformation agenda.

The application of renewable energy has the potential not only to raise Sierra Leone's growth rate, but also to deepen its effect on other sectors of the economy. More adequate, reliable and affordable power supply will, for instance, enhance the modernization of agriculture and, in turn, support increased quality of life. Job creation, productive use and business development as well as improved social service delivery are likely results of implementing the action plan (Tarawalli. P, 2014).

Economic Justification of the Policy

Sierra Leone is blessed with abundant primary energy resources. These include crude oil and natural gas reserves and renewable energy resources such as hydro, fuel-wood, solar, wind and biomass. However, since independence (1961), the economy has been highly dependent on the importation of petroleum products to meet its electricity demand, while biomass remains the major source of energy in the country.

Renewable energy is a clean and sustainable form of energy and contributes highly to improving the country's socio-economic conditions. Renewable energy services could add monetary value, increase affordability and improve customers' willingness to pay for services.

Sierra Leone's formal business sector is relatively small and gradually evolving, but the country is rated as one of the world's top ten business reformers, improving its ranking from 176 (out of 185 countries) to 140 within a five-year period. The country has witnessed significant private sector business transactions as foreign direct investment (FDI) has increased three-fold during the past five years. Even though substantial infrastructure investments have occurred between 2009 and 2013, the gaps continue to be significant (Economic Outlook 2014).

Currently, fuel-wood accounts for over 93% of overall domestic primary energy consumption in the country and is the dominant source of energy in the domestic sector. It is also used in other sectors of the economy, such as cottage industries. Over the years the fuel-wood supply/demand imbalance in some parts of the country has adversely affected the population's economic well-being. At the national level, increasing fuel-wood consumption contributes to deforestation, with consequences for desertification and soil erosion. This action plan is also aimed at developing a robust forest management programme, in collaboration with the forestry sector, for sustainable use of fuel-wood energy, in order to reduce the rapid depletion of wood.

Solar energy is an abundant resource throughout the country and is widely used, particularly for drying agricultural products. However, its use as a source of electricity is largely non-existent, with the exception of some public lighting and in some homes. Increased electricity production through this source offers a potential solution for powering the country's rural development (National Energy Profile, 2012).

Offshore and onshore wind power plants are also considered to have great energy potential that can contribute to a more sustainable and ecologically sound energy generation landscape. However, like any other power generation project, wind farms are capital intensive and require a high degree of precision technology. Generally, wind parks are technically feasible at wind speeds of approximately 6 m/s and more. Therefore, Global Atlas – IRENA 2015 have indicated that Sierra Leone has a very good potential to harness energy from wind with an average wind velocity of 3 m/s to 8 m/s, especially in the south, east, coastal areas and offshore.. Small wind generators can be used in off-grid electricity generation on farms, in rural areas, and in homes. Such technology is simple and largely affordable.

Energy security and growth

Achieving sustainable energy security and growth through diversification of supply in Sierra Leone has remained one of the National Energy Policy's key challenges, since a major portion of the nation's electricity expenditure is heavily dependent on dollar-denominated imported fuels, which impose a heavy burden on the economy.

In Sierra Leone, over-dependence on subsidized petroleum products as primary energy sources has slowed down the development of renewable energy. Diversification to achieve a wider energy supply mix will ensure greater energy security for the nation.

The development of renewable energy from locally available energy resources should therefore be vigorously pursued. More evenly distributed power generation is an important consideration for the country's energy sector, in terms of energy security and geo-political balance.

The rural populaces, whose needs are often basic, depend to a large extent on traditional sources of energy, mainly biomass, used on inefficient appliances. This class of fuels for domestic consumption constitutes over

93% of total energy consumption in the country. Fuel-wood supply/demand imbalance in some parts of the country is now a real threat to the energy security of the rural communities. Electricity supply in rural areas is largely non-existent, inhibiting access to such things as lighting and refrigeration to almost 75% of the nation.

The Government of Sierra Leone, through the Ministry of Energy, has initiated activities as part of its Integrated Electrification Plan; such as the development of schemes for providing hydropower electricity generation and solar photovoltaic street lights and solar lanterns to district headquarter towns that are expected to replace candles, illuminating paraffin and battery charging. Hence, special attention needs to be paid to the diversification of the energy supply mix in the rural areas.

For further background information, e.g. on RE potential, as well as details on the RE policy, programmes, plans, other stakeholders etc. please refer to the baseline report that will be published on the ECREEE website.

3 SUMMARY OF TARGETS

The tables 1 - 5 below show the status of renewable energy penetration within the grid system in 2010 and the targets Sierra Leone intends to achieve by 2020 and 2030 as a contribution to the attainment of the targets of the ECOWAS Renewable Energy Policy.

Table 1: Targets for grid connected RE

Installed capacity	**2010**	**2020**	**2030**
Renewable energy installed capacity in MW (including large and medium scale hydro)	56	659	1,229
Renewable energy share of the total installed capacity in % (including medium and large hydro)	57.8	52.3	65.3
Grid-connected generation	**2010**	**2020**	**2030**
Total renewable energy generation in GWh (including medium and large hydro)	152.52	3,505.64	6,686.76
Renewable energy share in the electricity mix in % (including medium and large hydro)	78.4	52.3	65.3

Source: MoE, SSL, EDSA, EGTC, Tarawalli, P. Energy Consultant & Team (2014)

Table 2: Targets for off-grid applications

	2010	**2020**	**2030**
Share of rural population served by off-grid (mini-grids and stand-alone) renewable energy electricity services in %	0.4	14	37

Source: MoE, SSL, EDSA, EGTC, Tarawalli, P. Energy Consultant & Team (2014)

Table 3: Targets for domestic cooking energy

	2010	2020	2030
Share of population using improved cook stoves in %	12.6	45	75
Share of charcoal produced by efficient charcoal production technologies in %	1	16	36
Share of population using modern fuel alternatives for cooking (e.g. LPG, biogas, solar cookers, ethanol gel fuel, etc.) in %	1	15	25

Source: MoE, SSL, MAFFS, PU, EUEI-PDF, Tarawalli, P. Energy Consultant & Team (2014).

Table 4: Targets for solar water heaters

Solar water heaters for sanitary hot water and preheating of industrial process water	2010	2020	2030
No. of residential buildings with solar thermal systems	12	480	1,880
Share of district health centres, maternities, school kitchens and boarding schools with solar thermal systems in %	0.1	55	100
Share of agro-food industries (preheating of process water) with solar thermal systems in %	0	25	60
Share of hotels with solar thermal systems in %	0.8	35	80

Source: MoE, SSL, MAFFS, PU, EUEI-PDF, Tarawalli, P. Energy Consultant & Team (2014).

Table 5: Targets for biofuels

	2010	2020	2030
Biofuels (1st generation)			
• Ethanol as share of gasoline consumption;	0.0:1	0.25:1	0.3:1
• Biodiesel as share of diesel and fuel oil consumption	0.000004:1	0.0001:1	0.0002:1

Source: MoE, SSL, MAFFS, PU, EUEI-PDF, Tarawalli, P. Energy Consultant & Team (2014).

4 RENEWABLE ENERGY TARGETS AND TRAJECTORIES

4.1 Grid-connected renewable energy targets

Targets for grid-connected renewable energy share within the national electricity mix for the years 2020 and 2030 are shown in Table 6 . The expected trajectory for the growth of renewable energy use in each sector between 2010, 2020 and 2030 is developed based on the MoE strategy plan of action. The targets set will contribute to the achievement of the targets set in the EREP.

Table 6: Targets for the share of grid-connected renewable energy in 2010, 2020 and 2030

Installed capacity	**2010**	**2020**	**2030**
Renewable energy installed capacity in MW (excluding medium and large hydro)	6	149	293
Renewable energy share of the total installed capacity in % (excluding medium and large hydro)	5.8	11.8	13.3
Large and medium scale hydropower capacity installed in MW (more than 30 MW)	50	510	935
Large and medium scale hydropower (more than 30 MW) share of total electricity generation in %	52	40.5	42.5
Total renewable energy capacity in MW (including large and medium scale hydro)	56	659	1,229
Renewable energy share of the total installed capacity in % (including medium and large hydro)	57.8	52.3	65.3
Grid-connected generation	**2010**	**2020**	**2030**
Renewable energy electricity generation in GWh (excluding medium and large hydro)	10.92	645.84	1,265.76
Renewable energy share in the electricity mix in % (excluding medium and large hydro)	5.6	9.1	10.2
Large and medium scale hydropower generation in GWh (more than 30 MW)	141.6	2,864	5,371
Large and medium scale hydropower generation (more than 30 MW) as share of electricity mix in %	72.8	40.5	43.5
Total renewable energy generation in GWh (including medium and large hydro)	152.52	3,505.64	6,686.76
Renewable energy share in the electricity mix in % (including medium and large hydro)	78.4	52.3	65.3

Table 7: National 2020 and 2030 targets and estimated trajectory of grid-connected renewable energies (MW)

	2010	2013	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW
Small hydro (up to 30 MW)	6	6.25	23	23	29	38	40	42	50	55	61	73	77	90	105	109	115	126
Medium and large hydro (more than 30 MW)	50	50	50	122	182	254	306	510	643	662	704	793	793	830	830	897	897	935
Solar	0	2.25	22	27	46	56	63	73	74	77	79	88	89	90	91	92	93	95
Wind	0	0	0	0	1	1	1	2	2	2	3	3	3	3	4	4	4	5
Bioenergy	0	0	15	15	17	17	32	32	41	43	44	50	55	57	61	63	65	68
Total	**56**	**58.5**	**110**	**187**	**275**	**366**	**442**	**659**	**810**	**839**	**891**	**1007**	**1017**	**1070**	**1091**	**1165**	**1174**	**1,229**

Source: MoE, SSL, EDSA, EGTC, MAFFS, EUEI-PDF 2013, Tarawalli, P. Energy Consultant & Team (2014)

Table 8: National 2020 and 2030 targets and estimated trajectory of grid-connected renewable energy generation (GWh)

	2010	2013*	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh	GWh
Small hydro (up to 30 MW)	10.9	14.9	115	122.2	157.9	189.6	211.8	223.6	260	292.5	329.4	388.7	409.8	467.9	559.2	566.8	598	680.4
Medium and large hydro (more than 30 MW)	141.6	132.9	250	648.4	991.3	1,267.9	1,620.5	2,716.2	3,344.2	3,521.1	3,802.3	4,222.7	4,222.7	4,315.1	4,420.5	4,664.4	4,864.4	5,049

Solar	0	14.3	110	143.5	250.5	279.5	333.6	384.7	388.8	409.5	426.6	468.6	473.7	487.9	499.6	508.4	513.6	523
Wind	0	0	0	0	4.9	5.4	5.6	10.4	10.6	10.6	14.2	15.9	16.9	17.9	21.3	21.8	22.8	27
Bioenergy	0	0	75	75	84.8	92.5	169.4	170.4	213.2	228.7	237.6	266.2	292.7	296.3	324.8	327.6	338	367.2
Total	**152.5**	**162.1**	**552**	**994**	**1,489.7**	**2,235.2**	**2,341.4**	**3,505.6**	**4,217**	**4,463**	**4,810.2**	**5,362.2**	**5,415.9**	**5,583.3**	**5,825.6**	**6,089**	**6,336.8**	**6,686.7**

Source: MoE, SSL, EDSA, EGTC, MAFFS, EUEI-PDF 2013, Tarawalli, P. Energy Consultant & Team (2014)

4.2. Off-grid renewable energy targets

Table 9 shows the electrification targets for 2020 and 2030, in general, as well as for the expected contribution of renewable energy based stand-alone systems and mini-grids. The trajectory expected for the growth of population with access to electricity between 2010, 2020 and 2030 is shown in Tables 10, 11 and 12. The national targets set will contribute to the achievement of the regional rural renewable energy electrification targets in the EREP.

Table 9: Contribution of renewable energy to electricity access targets

	2010	2020	2030
Share of population served by electricity services (%)	8.6	44	92
Share of population connected to the grid (%)	8.2	30	55
Share of rural population served by renewable energy and hybrid mini-grids (%)	0.4	11	27
Share of rural population served by standalone renewable energy systems (%)	0.003	3	10
Number of RE/hybrid mini-grids	2	25	65

Source: MoE, SSL, EDSA, EGTC, Tarawalli, P. Energy Consultant & Team (2014)

Table 10: National 2020 and 2030 targets and estimated trajectory for rural population served by RE

	2010	2013	2015	2016	2017	2018	2019	2020	2021
Total rural population (number of inhabitants)	**3,441,845**	**3,599,328**	**3,904,235**	**4,001,841**	**4,101,886**	**4,204,434**	**4,309,545**	**4,417,283**	**4,527,715**
Rural population served by electricity services (number of inhabitants)	34,418	179,966	585,635	840,387	1,025,472	1,177,242	1,379,054	1,590,222	1,811,086
Rural population served by electricity services (% of total)	1	5	15	21	25	28	32	36	40
Rural population served by renewable electricity services (RE only and hybrid) (number of inhabitants)	13,767	17,996	78,085	200,092	287,132	378,399	474,050	574,247	633,880
Rural population served by renewable electricity services (RE only and hybrid) (%)	0.4	0.5	2	5	7	9	10	11	14

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Total rural population (number of inhabitants)	**4,640,909**	**4,756,931**	**4,875,854**	**4,997,751**	**5,122,695**	**5,250,762**	**5,382,031**	**5,516,581**	**5,654,496**

Rural population served by electricity services (number of inhabitants)	2,134,818	2,378,366	2,535,444	2,698,786	2,868,709	3,045,442	3,229,219	3,585,778	3,958,147
Rural population served by electricity services (in % of total)	46	50	52	54	56	58	60	65	70
Rural population served by renewable electricity services (RE only and hybrid) (number of inhabitants)	696,136	761,109	877,654	949,573	1,024,539	1,102,660	1,237,867	1,379,145	1,526,714
Rural population served by renewable electricity services (RE only and hybrid) (%))	15	16	18	19	20	21	23	25	27

Note: This table is provided in the Excel Workbook developed with this template: spreadsheet "4.2(B).

Table 11: National 2020 and 2030 RE targets and estimated trajectory for rural population, disaggregated by gender

	2010		2013		2015		2016		2017		2018		2019		2020		2021	
	W	M	W	M	W	M	W	M	W	M	W	M	W	M	W	M	W	M
Total rural population (number of	**1,782,876**	**1,658,969**	**1,864,452**	**1,734,876**	**2,030,202**	**1,874,033**	**2,080,957**	**1,920,884**	**2,132,981**	**1,968,905**	**2,186,306**	**2,018,128**	**2,240,963**	**2,068,582**	**2,296,987**	**2,120,296**	**2,354,412**	**2,173,303**

women (W) and men (M))																		
Rural population served by electricity services (number of women and men)	17,829	16,589	93,222	86,744	304,530	281,105	437,001	403,386	533,245	492,227	612,166	565,076	717,108	661,946	826,915	763,307	941,765	869,321
Women and men in rural areas served by electricity services (%)	1	1	5	5	15	15	21	21	25	25	28	28	32	32	36	36	40	40
Women and men in rural areas	179	165	9358	8638	40,604	37,480	104,048	960,44	149,309	137,823	196,767	181,632	246,506	227,544	298,608	275,639	329,618	304,262

served by renewable electricity services (RE only and hybrid) (number of women and men)																		
Women and men in rural areas served by renewable electricity services (RE only and hybrid) (%))	0.4	0,4	0.5	0.5	2	2	5	5	7	7	9	9	11	11	13	13	14	14

	2022		2023		2024		2025		2026		2027		2028		2029		2030	
	W	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**	**W**	**M**
Total rural population (number of women (W) and men (M))	**2,413,273**	**2,227,636**	**2,473,604**	**2,283,327**	**2,535,444**	**2,340,410**	**2,598,831**	**2,398,920**	**2,663,801**	**2,458,894**	**2,730,396**	**2,520,366**	**2,798,656**	**2,583,375**	**2,868,622**	**2,647,959**	**2,940,338**	**2,714,158**
Rural population served by electricity services (number of women and men)	1,110,105	1,024,713	1,236,802	1,14 16,64	1,318,431	1,217,013	1,403,369	1,295,417	1,465,091	1,352,391	1,583,630	1,461,812	1,679,194	1,550,025	1,864,605	1,721,173	2,058,236	1,899,911
Women and men in rural areas	46	46	50	50	52	52	54	54	55	55	58	58	60	60	65	65	70	70

served by electricity services (%)																		
Women and men in rural areas served by renewable electricity services (RE only and hybrid) (number of inhabitants)	361,991	334,145	395,777	365,332	456,380	421,274	493,778	455,795	532,760	491,779	573,383	529,277	643,691	594,176	717,155	661,990	793,891	732,823
Women and men in rural areas served by	15	15	16	16	18	18	19	19	20	20	21	21	23	23	25	25	27	27

renewable electricity services (RE only and hybrid) (%))																	

Table 12: National 2020 and 2030 targets and estimated trajectory for off-grid RE systems

	2010	2013	2015	2016	2017	2018	2019	2020	2021
Mini-grids (RE and Hybrid) (in MW of installed capacity)	0	0.25	31	43	48	54	64	70	78
PV, pico-hydro and small scale wind systems (MW)	0	0.02	4	6	8	10	14	16	20
Total off-grid RE installed capacity (MW)	**0**	**0.27**	**35**	**49**	**56**	**64**	**78**	**86**	**98**

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Mini-grids (RE and Hybrid) (in MW of installed capacity)	88	93	101	104	119	121	126	129	134
PV, pico-hydro and small scale wind systems (MW)	24	28	32	34	38	40	42	44	44

Total off-grid RE installed capacity (MW)	**112**	**121**	**133**	**138**	**157**	**162**	**168**	**173**	**178**

4.3. Renewable energy applications for domestic uses

4.3.1. Domestic cooking energy targets

Tables 13, 14 and 15 show the targets regarding renewable energy applications for domestic use in 2020 and 2030 as well as its trajectory.

Table 13: Domestic cooking energy targets for 2020 and 2030

	2010	2020	2030
Share of the population using improved cook stoves in %	12.6	45	75
Share of charcoal produced using efficient technologies in %	1	16	46
Share of the population using modern fuel alternatives for cooking (e.g. LPG, biogas, solar cookers) in %	1	15	25

Table 14: National 2020 and 2030 targets and estimated trajectory for domestic cooking energy

	2010	2013	2015	2016	2017	2018	2019	2020	2021
Population using improved cook stoves (number of inhabitants)	**724,097**	**1,114,250**	**1,496,624**	**1,800,828**	**2,050,943**	**2,382,513**	**2,729,378**	**3,312,963**	**3,697,635**
Share of total population using improved cook stoves in %	12.6	18	23	27	30	34	38	45	49
Total charcoal production in tonnes	85,000	133,5 00	166,305	179,195	192,170	216,256	232,507	247,242	260,972
Charcoal production with efficient technologies (yield superior to 25%) in tonnes	850	1,335	3,489	7,752	14,217	21,613	29,201	39,448	48,524
Share of charcoal produced with efficient technologies in %	1	1	2	4	7	10	12	16	19
Population using modern cooking fuel alternatives (LPG, biogas, solar cookers) (number of inhabitants)	57,468	74,283	260,282	400,184	546,918	700,739	933,735	1,104,321	1,207,391

Share of population using modern fuel alternatives for cooking (e.g. LPG, biogas, solar cookers) (% of the total population)	1	1.2	4	6	8	10	13	15	16

	2022	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Population using improved cook stoves (number of inhabitants)	4,099,469	4,519,085	4,875,854	5,330,934	5,720,343	6,213,402	6,548,138	6,803,784	7,068,121
Share of total population using improved cook stoves in %	53	57	60	64	67	71	73	74	75
Total charcoal production in tonnes	287,891	302,006	313,997	339,377	354,751	369,621	397,674	406,231	421,803
Charcoal production with efficient technologies (yield superior to 25%) in tonnes	59,473	70,562	87,679	104,176	121,900	137,437	151,953	167,428	185,902
Share of charcoal produced using efficient technologies in %	21	24	28	32	36	39	41	43	46
Population using modern cooking fuel alternatives (LPG, biogas, solar cookers) (number of inhabitants)	1,314,924	1,427,079	1,544,021	1,665,917	1,792,943	1,925,279	2,063,112	2,206,633	2,356,040

Share of the population using modern fuel alternatives for cooking (e.g. LPG, biogas, solar cookers) (% of the total population)	17	18	19	20	21	22	23	24	25

Table 15: National 2020 and 2030 targets and estimated trajectory for domestic cooking energy disaggregated by gender

	2010		2013		2015		2016		2017		2018		2019		2020		2021	
	W	M	W	M	W	M	W	M	W	M	W	M	W	M	W	M	W	M
Number of women (W) and men (M) using improved cook stoves	615482	108,615	947,113	167,137	1,272,130	224,494	1,530,704	270,124	1,743,302	307,641	2,025,136	357,377	,319,971	409,407	2,816,019	496,944	3,142,990	554,645
Share of total women and men using improved cook stoves in %	10.71	1.89	15.3	2.7	19.55	3.45	22.95	4.05	25.5	4.5	28.9	5.1	32.3	5.7	38.25	6.75	41.65	7.35

Total charcoal produced by women and men in tonnes	35,000	51,000	37,400	56,100	46,522	69,783	51,678	77,517	56,868	85,302	66,502	99,754	72,203	108,304	78,897	118,345	84,389	126,583
Charcoal produced with efficient technologies (yield superior to 25%) by women and men in tonnes	170	680	187	748	698	2,791	1,550	6,202	2,843	11,374	4,323	17,290	5,840	23,361	7,890	31,558	9,705	38,819
Share of charcoal produced using efficient technologies by women and men in %	0.2	0.8	0.2	0.8	0.4	1.6	0.8	3.2	1.4	5.6	2	8	2.4	9.6	3.2	12.8	3.8	15.2

Number of women and men using modern cooking fuel alternatives (LPG, biogas, solar cookers)	45,974	11,494	59,426	14,857	208,226	52,056	320,147	80,037	437,534	109,384	560,591	140,148	746,988	186,747	883,457	220,864	965,913	241,478
Share of women and men using modern fuel alternatives for cooking (e.g. LPG, biogas, solar cookers) (% of the female and male population)	1.57	0.4	1.88	0.49	6.2	1.65	9.3	2.47	12.43	3.38	15.53	4.12	20.19	5.41	23.3	6.18	24.85	6.59

	2022		2023		2024		2025		2026		2027		2028		2029		2030	
	W	M	W	M	W	M	W	M	W	M	W	M	W	M	W	M	W	M
Number of women (W) and men (M) using improved cook stoves	3,484,549	614,920	3,841,222	677,863	4,144,476	731,378	4,531,294	799,640	4,862,292	858,051	5,281,392	932,010	5,565,917	982,221	5,783,216	1,020,568	6,007,903	1,060,218
Share of total women and men using improved cook stoves in %	45.05	7.95	48.45	8.55	51	9	54.4	9.6	56.95	10.05	60.35	10.65	62.05	10.95	62.9	11.1	63.75	11.25
Total charcoal produced by women and men in tonnes	95,156	142,735	100,802	151,204	109,599	164,398	115,751	173,626	121,900	182,851	127,848	191,773	135,070	202,604	142,492	213,739	148,721	223,082

Charcoal produced with efficient technologies (yield superior to 25%) by women and men in tonnes	11,895	47,578	14,112	56,450	17,536	70,143	20,835	83,341	24,380	97,520	27,487	109,950	30,391	121,562	33,486	133,942	37,180	148,722
Share of charcoal produced using efficient technologies by women and men in %	4.2	16.8	4.8	19.2	5.6	22.4	6.4	25.6	7.2	28.8	7.8	31.2	8.2	32.8	8.6	34.4	9.2	36.8
Number of women and men using modern cooking fuel	1,051,939	262,985	1,141,663	285,416	1,235,217	308,804	1,332,734	333,183	1,434,354	358,589	1,540,223	385,056	1,650,490	412,622	1,765,306	441,327	1,884,832	471,208

alternatives (LPG, biogas, solar cookers, kerosene)																		
Share of women and men using modern fuel alternatives for cooking (e.g. LPG, biogas, solar cookers) (% of the female and male population)	26.41	7.01	27.96	7.42	29.51	7.84	31.06	8.23	32.62	8.66	34.17	9.07	35.73	9.48	37.28	9.89	38.83	10.31

Source: MoE, SSL, EDSA, EGTC, MAFFS, EUEI-PDF 2013, Tarawalli, P. Energy Consultant & Team (2014).

4.3.2. Solar thermal water heating

Tables 16 and 17 show the targets regarding the use of solar thermal water heating technologies for domestic homes, public institutions and industrial purposes in 2020 and 2030.

Table 16: Solar thermal water heating targets for 2020 and 2030

Solar water heaters for sanitary hot water and preheating of industrial process hot water	**2010**	**2020**	**2030**
No. of residential buildings with solar thermal systems	12	480	1,880
Share of district health centres, maternities, school kitchens and boarding schools with solar thermal system in %	0.1	55	100
Share of agro-food industries (preheating of process water) with solar thermal systems in %	0	25	60
Share of hotels with solar thermal systems in %	0.8	35	80

Table 17: National 2020 and 2030 targets and estimated trajectory of solar thermal water heating applications

	2010	2013	2015	2016	2017	2018	2019	2020	2021
Residential sector (number of buildings with solar thermal systems)	12	33	55	105	195	315	455	480	600
Share of district health centres, maternity clinics, school kitchens and boarding schools with solar thermal systems in %	0.1	0.3	25	30	35	40	48	55	60
Share of agro-food industries with solar thermal systems (preheating of process water) in %	0	1	8	13	18	21	23	25	30
Share of hotels with solar thermal systems in %	0.8	1	11	16	19	25	30	35	40
Solar thermal installed capacity in MW	0.7	1.3	3	4	5	6	7	8	9

	2022	2023	2024	2025	2026	2027	2028	2029	2030
Residential sector - (number of buildings with solar thermal systems)	720	850	970	1090	1220	1340	1455	1670	1880
Share of district health centres, maternity clinics, school kitchens and boarding schools with solar thermal systems in %	65	70	75	80	85	90	95	98	100
Share of agro-food industries with solar thermal systems (preheating of process water) in %	35	40	45	50	52	54	56	58	60

Share of hotels with solar thermal systems installed in %	45	50	55	60	65	70	73	77	80
Solar thermal installed capacity in MW	10	11	13	16	19	20	22	24	25

4.3.3. Biofuels

Table 18: Biofuels targets for 2020 and 2030

Biofuels (1st generation)	2010	2020	2030
Ethanol as share of gasoline consumption (%)	0.0:1	0.25:1	0.3:1
Biodiesel as share of diesel and fuel-oil consumption (%)	0.000004:1	0.0001:1	0.0002:1

Table 19: National 2020 and 2030 targets and estimated trajectory of biofuel usage. A large volume of ethanol produced in Sierra Leone is exported.

	2010	2013	2015	2016	2017	2018	2019	2020	2021
Total national gasoline consumption (litres)	78,297 MT	110422MT	172534	215668	269585	336981	421227	526533	658166
Total national diesel/fuel oil/DDO consumption (litres)	123,096 MT	266264MT	416038	520047	650059	812573	1015717	1269646	1587057
Total national production of biodiesel and SVO (litres)	0.5MT	0.8MT	4.16	10.4	26	48.75	81.25	127	174.6
Total national ethanol production (litres)	0	0	40,200 MT	50,682	64700	82560	104465	131633	167833
Total national biodiesel and SVO consumption (litres)	0.5MT	0.8MT	4.16	10.4	26	48.75	81.25	127	174.6
Total national ethanol consumption (litres)	0	0	40,200 MT	50,682	64700	82560	104465	131633	167833
Ethanol as share of national gasoline consumption (%)	0	0	23.3	23.5	24	24.5	24.8	25	25.5

Biodiesel as a share of national diesel and fuel-oil/DDO consumption (%)	0.0004	0.0003	0.001	0.002	0.004	0.006	0.008	0.01	0.011

	2022	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Total national gasoline consumption (litres)	822708	1028385	1285481	1606852	2008564	2510706	3138382	3922977	4903722
Total national diesel/fuel oil/DDO consumption (litres)	1983821	2479777	3099721	3874651	4843314	6054142	7567678	9459598	11824497
Total national production of biodiesel and SVO (litres)	238	322	434	581.2	775	1029	1362	1797	2365
Total national ethanol production (litres)	213904	272522	347080	441884	562398	715551	910131	1157278	1471117
Total national raw vegetal/biodiesel consumption (litres)	238	322	434	581.2	775	1029	1362	1797	2365
Total national ethanol consumption (litres)	213904	272522	347080	441884	562398	715551	910131	1157278	1471117
Ethanol as share of national gasoline consumption (%)	26	26.5	27	27.5	28	28.5	29	29.5	30
Biodiesel as a share of national diesel and fuel-oil/DDO consumption (%)	0.012	0.013	0.014	0.015	0.016	0.017	0.018	0.019	0.02

5. MEASURES FOR ACHIEVING THE TARGETS

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5.1. Summary tables of all policy measures to promote the use of renewable energy resources for grid connected and off-grid electricity generation, domestic cooking energy, solar water heating and biofuels

Table 20: Overview of policies and measures for grid-connected RE

	Name of the measure	Type of measure	Expected results	Target group and/or activity	Existing or planned	Start and end dates of the measure
1	**Development and adoption of an Energy Act**	Regulation	Laws for Energy Administration & Management	All stakeholders of the energy sector	Planned	2015 - 2016
2	**Development and adoption of Renewable Energy Act**	Regulation	Enforce Laws for Renewable energy Administration & Management	MoE, investors, planners, public and private administration, rural and urban population etc.	Planned	2015 - 2016
3	**Reviewing the National Energy Policy, 2009**	Policy	Compliment RE policy direction efforts	MoE, investors, planners, public and private administration, rural and urban population etc.	Planned	2015 - 2016
4	**Implementing National Electricity Act 2011**	Regulation	Established EDSA and EGTC	MoE, investors, utility management, customers (end-users), public and private sector, rural and urban population	Existing	2011 - 2016
5	**Implementing Electricity and Water Regulatory Commission Act 2011**	Regulation	Authorisation, certification and issuing of licenses to RE investors.	MoE, investors, utility management, customers (end-users), public and private sector, rural and urban population	Existing	2011 - 2016
6	**Reviewing the Power Generation Act 2006**	Regulation	Public Private Partnership projects in the RE power generation trade	MoE, EWRC, EGTC, investors, rural and urban population, public administration etc.	Existing	2006 - date
7	**Promoting the Financing Act 2011 on duty free tax waivers on RE**	Financial	Access to funds, awareness raising	Investors, end users, public administration, installers, urban or rural	Planned	2015 - 2017

	equipment and materials			population		
8	**Holding workshops and media programmes to remove barriers hampering the effective development, implementation and dissemination of RETs**	Soft	Behavioural change	Public administration, urban or rural population	Planned	2015 - 2018
9	**Providing incentives for the importation and application of renewable equipment/ devices.**	Financial	Access to RE technologies	Investors	Planned	2015 - 2018
10	**Developing and adopting a Renewable Energy Act.**	Regulation	Access to legal directions	Public administration, urban or rural population	Planned	2015 - 2018
11	**Introducing Power Production Tax Credit (PTC) to RE generation companies which is aimed at incentivizing the adoption of renewable energy.**	Financial	Funds to accelerate RE	Investors, MoE, MoFED,	Planned	2015 - 2020
12	**Providing affordable Feed-in-Tariffs (FIT) for RE to incentivize electricity producers.**	Financial	Access to funds	Investors, electricity producers, MoE, MoFED, EWRC	Planned	2015 - 2018
13	**Adopting the Public Benefits Fund (PBF) which requires that a certain**	Financial	Access to energy and funds	MoFED, MoE, EWRC, end-users, rural and urban population,	Planned	2015 - 2025

	percentage of the tariff is dedicated to supporting renewable energy generation projects (grid connected)			investors		
14	**Setting up institutions to produce and assemble RE devices**	Regulation	New technologies on RE	Installers, investors, Planners R & D engineers, installers, investors, planners	Planned	2015 to 2030
15	**Monitoring the contribution of RE in the national energy mix.**	Regulation	Increase access to energy	Planners, MoE, public administration	Planned	2015 to 2020
16	**Raising public and stakeholder awareness of the benefits and opportunities of renewable energy.**	Soft	Increase awareness of RE, behavioural change	Rural and urban population, end-users, investors	Planned	2015 to 2030
17	**Establishing Research and Development work in renewable energy matters, as well as linkages with countries active in RET research and development.**	Regulation	New innovations	R & D Engineers, Investors, Trainers	Planned	2015 to 2030
18	**Training in RETs in tertiary and other learning institutions.**	Soft	Capacity building	RE institution	Planned	2015 to 2030
19	**Development of the hydropower resources in the**	Regulation	Access to energy	Investors	Planned	2015 to 2030

	country, including development of large hydro schemes.					
20	**Public private partnerships and indigenous participation in hydropower development.**	Regulation	Public Private Partnership sector ownership	Public Private Partnership sector, Investors, MoE	Planned	2015 to 2020
21	**Providing financial incentives to increase the percentage of solar energy in the electricity mix.**	Regulation	Increase RE power generation	Investors, end-users, planners, installers, Public administration	Planned	2015 to 2025
22	**Establishing sustainable costs to both producers and consumers in the rural and coastal areas.**	Financial	Wind power installed along the coastal and rural areas	Investors, end-users, urban and rural population, Public administration	Planned	2015 to 2025
23	**Ensuring that Environmental considerations are included in all renewable energy planning and implementation.**	Regulation	Minimizing environmental impact of RE projects	End-users, investors, Public administration	Planned	2015 to 2020
24	**Exploiting Clean Development Mechanism (CDM) to assess and package renewable energy projects.**	Financial	Improve the financial feasibility of projects and provide incentives to reduce GHG emissions	Investors, public administration	Planned	2015 to 2018
25	**Supporting public private partnership projects in the promotion and**	Regulatory	Behavioural change	Public authorities, companies in the fields of renewable	Planned	2015 to 2018

	development of renewable energy fuels, devices and technologies at competitive prices.			energy fuels, devices and technologies		
26	**Conducting zoning and resource assessment to identify renewable power development zones in areas with high resource potential and routes for electricity transmission.**	Soft	Increase access to renewable energy	Public administration, urban or rural population	Planned	2015 to 2018

Table 21: Overview of policies and measures for off-grid RE

	Name of the measure	Type of measure	Expected results	Target group and/or activity	Existing or planned	Start and end dates of the measure
1	**Development and adoption of an Energy Act**	Regulation	Laws for energy administration & management	All stakeholders in the energy sector	Planned	2015 - 2016
2	**Reviewing National Energy Policy, 2009**	Policy	Clear policy direction on energy matters	MoE, investors, planners, public and private administration, rural and urban population etc.	Existing	2009 - 2016
3	**Implementing the Electricity and Water Regulatory Commission Act 2011**	Regulation	Authorisation, certification and issuing of licenses	MoE, investors, utility management, customers (end-users), public and private sector, rural and urban population	Existing	2011
4	**Implementing the Financing Act 2011**	Financial	Access to funds,	Investors, end users, public administration,	Planned	2015 to

	on duty free tax waivers on RE equipment and materials		awareness raising	installers, urban or rural population,		2017
5	**Providing incentives for the importation and application of renewable equipment/ devices.**	Financial	Access to RE Technologies	Investors, RE technology providers	Planned	2015 to 2018
6	**Developing and adopting a Renewable Energy Act.**	Regulation	Access to Legal Directions	Public administration, urban or rural population	Planned	2015 to 2018
7	**Prioritising the installation of RETs in remote and underdeveloped communities**	Regulation	Increase access to RETs	Investors, installers, MoE, rural population	Planned	2015 to 2030
8	**Raising public and stakeholder awareness of the benefits and opportunities of renewable energy in remote communities.**	Soft	Increase awareness of RE, Behavioural Change	Rural and urban population, end-users, investors	Planned	2015 to 2030
9	**Conducting feasibility studies and research in renewable energy for off-grid projects.**	Regulation	New Innovations	R & D Engineers, Investors, Trainers,	Planned	2015 to 2030
10	**Training in RETs in tertiary and other learning institutions.**	Soft	Capacity building	RE institution	Planned	2015 to 2030
11	**Development of hydropower resources in the country, including development of pico-hydro schemes.**	Regulation	Access to energy	Investors	Planned	2015 to 2030
12	**Encouraging Public Private Partnerships and indigenous participation in the remote and off-grid sectors.**	Regulation	Public Private Partnership sector ownership	Public Private Partnership sector, investors, MoE	Planned	2015 to 2020
13	**Developing solar battery disposal**	Regulatory	Sites for safe disposal of	Solar battery companies, solar	Planned	2015 to

	mechanisms and ensuring strict adherence to implementing agencies		solar batteries	energy stakeholders		2020
14	**Introducing the efficient production and use of ethanol, bio-diesel sugar cane and sewage, municipal waste as renewable energy sources**	Regulation	Increase bio-fuel usage as RE fuel source	Investors, end-users, planners, installers, public administration	Planned	2015 to 2025
15	**Adopting Public Benefits Fund (PBF) which requires that a certain percentage of the tariff be dedicated to supporting renewable energy generation projects (grid connected and off-grid).**	Financial	Access to Energy and Funds	MoFED, MoE, EWRC, end-users, rural and urban population, investors	Planned	2015 to 2025

Table 22: Overview of policies and measures for domestic cooking energy

	Name of the measure	Type of measure	Expected results	Targeted group and or activity	Existing or planned	Start and end dates of the measure
1	**Developing appropriate and affordable efficient wood stoves and promoting the introduction of more resource efficient alternatives, in line with the national target**	Policy/Regulation	Behavioural change and increase energy generated	Stakeholders throughout the cook stove supply chain, public administration, general public, bioenergy sector	Planned	2015 to 2030
2	**Developing appropriate technologies**	Policy/regulation	Behavioural change	Bioenergy sector, public administration,	Planned	2015 to 2025

	for the utilization of alternative energy sources from fuel-wood.			general public, investors		
3	**Developing educational and outreach programmes to facilitate the general use of new biomass energy technologies**	soft	Behavioural change	General public, educational institutions, trainers, bioenergy sector, public administration	Planned	2015 to 2030
4	**Promoting Research and Development in bioenergy technology and cooking technologies and fuels.**	Regulation	Behavioural change and increase technology in cooking	Research and development institutions, public authorities, bioenergy sector	Planned	2015 to 2030

Table 23: Overview of policies and measures for solar water heating

	Name of the measure	Type of measure	Expected results	Targeted group and or activity	Existing or planned	Start and end dates of the measure
1	**Installing demonstration solar thermal systems for water heating in social institutions (hospitals, orphanages, and homes for elderly people, etc.) in order to increase the hygiene standard of the social institutions and to reduce water**	Soft	Behavioural change	Social service sector, public administration	Planned	2015 to 2025

	heating costs.					
2	**Conducting awareness campaigns on solar thermal systems to inform all relevant stakeholders and the interested population about the different applications of solar thermal energy and the related benefits**	soft	Behavioural change	All stakeholders of the energy sector, general public	Planned	2015 to 2025
3	**Sourcing and providing adequate incentives to local entrepreneurs to produce solar energy conversion systems.**	Financial	Behavioural change	Investors, programme developers, solar energy companies, business sector	Planned	2015 to 2030
4	**Establishing projects for the production of solar energy conversion devices and systems.**	Regulation	Access to energy, increase installed capacity and energy generated (see RE action plan)	Investors, programme developers, solar energy companies, business sector	Planned	2015 to 2030

Table 24: Overview of policies and measures for biofuels

	Name of the measure	**Type of measure**	**Expected results**	**Targeted group and or activity**	**Existing or planned**	**Start and end dates of the measure**
1	**Developing non-fuel-wood**	Policy/regulation	Behavioural	Bioenergy sector	Planned	2015 to 2030

	biomass and biofuel energy resources and integrating them with other energy resources		change	(including biofuels)		
2	**Developing agro based industries to produce electricity from their wastes**	Policy/ Regulation	Behavioural change	Industrial sector (focus: agro-based industries)	Planned	2015 to 2025
3	**Promoting the use of efficient liquid biofuel conversion technologies.**	Soft	Behavioural change	Bioenergy sector	Planned	2015 to 2030
4	**Introducing the Establishment of liquid biofuel blending activities**	Policy/regulation	Access to liquid biofuel	Bioenergy sector, trade, industry, university, investors, Addax bioenergy	Planned	2015 - 2016

5.2. Specific measures to fulfil the requirements under the EREP

5.2.1. Administrative procedures and spatial planning

List of existing national and, if applicable, regional legislation concerning authorisation, certification, licensing procedures and spatial planning applied to plants and associated transmission and distribution network infrastructure:

i. The National Energy Policy, 2009;

ii. The National Electricity Act, 2011;

iii. The Electricity and Water Regulation Commission Act, 2011;

iv. The Power Generation Act, 2006;

v. The Forestry Division Act;

vi. The Public Private Partnerships Act;

vii. The Finance Act, 2006;

viii. The Bumbuna Hydropower Project Act;

Responsible Ministry(/ies)/authority(/ies) and their responsibilities in the field:

i. The Ministry of Energy – Policy direction on Energy matters;

ii. The Ministry of Finance and Economic Development – Funding & Incentives;

iii. The Ministry of Trade and Industry – Trade, Industries;

iv. The Ministry of Agriculture, Forestry and Food Security – Forestry Management;

v. The Ministry of Local Government and Rural Development;

vi. The Public Private Partnerships Secretariats;

vii. Electricity Distribution and Supply Authority;

viii. Electricity Generation and Transmission Company;

ix. Energy Directorate;

x. Environmental Protection Agency;

xi. Electricity Water Regulatory Commission;

xii. Sierra Leone Standards Bureau.

Summary of the existing and planned measures at regional/local levels (where relevant):

There are existing policies such as the national energy policy, forest division policy, environmental protection agency policy, National Electricity Act, electricity and Water Regulation Commission Act etc.

For existing projects:

i. CLSG (WAPP) interconnection line – Planned – Regional Level;

ii. Energy Access Project is a World Bank funded project to rehabilitate the western area network in Freetown. PIU is implementing the project – Existing – Local Level;

iii. Installation of solar street lights – existing – Local level.

For planned programmes:

See chapter 5.1 for an overview of planned regulations

Unnecessary obstacles or non-proportionate requirements detected related to authorisation, certification and licensing procedures applied to plants and associated transmission and distribution network infrastructure for the production of electricity from renewable sources, and to the process of transforming biomass into biofuels or other energy products.

i. The Electricity and Water Regulation Commission may have limitations regarding the transformation of biomass into biofuels or other energy products. Establishing a blending mechanism that will address the transformation issue and is being handled by the Ministry of Energy, Trade & Industry and Sierra Leone Standards Bureau. Introducing effective and efficient coordination will minimize the delays in getting approvals from other MDAs, such as MoTI and MoFED;

ii. Implementing the renewable energy policy and regulatory mechanism will reduce the challenges that are posing some limitations within the energy sector.

Level of administration (local, regional and national) responsible for authorising, certifying and licensing renewable energy installations and spatial planning.

Under the supervision of the Ministry of Energy, the Energy Directorate is the national administrative body responsible for authorising, certifying and licensing renewable energy installations and spatial planning.

Comprehensive information on the processing of authorisation, certification and licensing applications and on assistance to applicants. Information and assistance is available to potential applicants for new renewable energy installations on their applications.

The renewable energy division under the Energy Directorate has application forms for potential RE registration applicants. The form is developed within specific requirements, such as the type of renewable energy technology, capacity, cost, environmental concerns, origin of make, specification etc. However, a website has not yet been created to access information on the processing of applications for new RE in the Ministry of Energy.

Horizontal coordination facilitated between different administrative bodies, responsible for the different parts of the permit.

The different administrative bodies that are responsible for issuing permits performed under a well-coordinated and flexible environment to achieve their objective...

Procedural steps needed to receive the final authorisation/licence/permit.

There are five steps before final authorization/licence/permit. There is currently no one-stop shop for the coordination of all steps, and timetables for processing applications are not communicated in advance. In general, a decision on the application can be obtained within four (4) weeks.

Authorisation procedures take into account the specificities of the different renewable energy technologies.

The specificities of different RETs shall be incorporated in a new application form.

Specific incentives for small-scale, decentralised off-grid installations (such as PVs or pico-hydro). The level of incentives. Micro-credit available, Micro-credit planned in the future. Types of installation / system.

The only incentive authorized by MoFED is a duty free concession on renewable energy equipment and goods.

Introduction of micro-credit and other financial and fiscal instruments are included in the Renewable Energy Policy, which is being formulated.

Official guidance available to local and regional administrative bodies on planning, designing, building and refurbishing industrial and residential areas to install equipment and systems using renewable energy sources in electricity and water heating.

The implementation of the RE, EE policy and Action Plan being developed will usher in official guidance to install equipment and systems using renewable energy sources in electricity and water heating. This will be done between 2015 and 2016.

Specific training for case handlers of authorisation, certification and licensing procedures regarding renewable energy installations.

Partnerships with ECOWAS and other developmental partners in the sub-region and on an international level enable specific training.

5.2.2. Technical specifications

Renewable energy technologies need to meet certain quality standards to benefit from support schemes. There are national, regional and international quality standards for RE.

5.2.3. Buildings

Reference to existing national and regional legislation (if any) and summary of local legislation concerning the increase in the share of energy from renewable sources in the building sector:

There is currently no existing legislation on renewable energy relating to the building sector implemented the Ministry of Works, Housing and Infrastructure.

However, the Ministry of Works, Housing and Infrastructure has the Freetown infrastructure and building codes Act, 1960 and is in the process of formulating a new Law that will incorporate energy and energy efficiency in buildings.

Responsible Ministry(/ies)/authority(/ies):

i. Ministry of Energy,

ii. Ministry of Works, Housing and Infrastructure;

Revision of rules, if any, planned by: [date]

i. National Energy Policy: December, 2015;

ii. National Renewable Energy Policy: December, 2015;

iii. National Energy Efficiency Policy: December, 2015;

iv. Freetown Infrastructure and Building Codes: December 2015,

v. Standards Bureau Codes and Specifications: December, 2015.

Summary of the existing and planned measures at regional/local levels:

The planned measures will be covered by this NREAP.

Minimum levels for the use of renewable energy in building regulations and codes. In geographical areas and requirements. In particular, measures built into these codes to ensure the share of renewable energy used in the building sector will increase. Future plans related to these requirements / measures.

Presently, there are no regulations and codes in place at the MoE and MoWHI for the use of renewable energy in buildings.

However, there is an ongoing process to develop new regulations and codes that will form part of the RE and building policies of MoE and MoWHI, respectively.

In doing so, it is being considered to set a required solar thermal contribution for new and renovated buildings (e.g. at least 60% of hot water energy consumption should be provided through solar thermal technologies), in accordance with the ECOWAS Directive on Energy Efficiency in Buildings (EDEEB).

Projected increase in renewable energy use in buildings until 2030 (differentiating between residential, commercial, public and industrial.)

Table 25: Increase in renewable energy use in buildings until 2030 (MW)

	2010	2015	2020	2025	2030
Residential	25	49	285	427	503
Commercial	7	14	85	132	159
Public	4	8	52	81	110
Industrial	20	39	237	377	457
Total (MW)	**56**	**110**	**659**	**1017**	**1229**

Obligations for minimum levels of renewable energy in new and newly refurbished buildings have been considered in national policy. The levels and the appropriateness of this policy option will be explored by 2020 and 2030.

The obligations for minimum levels of renewable energy in buildings have been considered in the Renewable Energy policy and measures to implement them will be put in place between 2015 and 2016. See 5.1;

Plans for ensuring the exemplary role of public buildings at national, regional and local levels by using renewable energy installations.

i. The Ministry of Energy is ensuring that the renewable energy and energy efficiency policy incorporates energy efficiency for buildings;

ii. The Ministry of Works, Housing and Infrastructure is also formulating regulations and codes for energy building.

Energy efficient renewable energy technologies in promoted buildings. (Such measures may concern biomass boilers, heat pumps and solar thermal equipment)

The new policy on renewable energy and energy efficiency will support RE and EE technologies in buildings, as well as the new building regulations and codes that are being developed by the Ministry of Works, Housing and Infrastructure.

5.2.4. Information provision

Reference to existing national and/or regional legislation (if any) concerning information requirements

No legislation has been implemented by the Ministry of Energy concerning information requirements for renewable energy. However, the renewable energy policy being developed will deal with the issue of information, awareness raising and campaigns.

The National Energy Policy 2009.

Body/(ies) responsible for disseminating information at national/regional/local levels:

i. Ministry of Energy;

ii. Due to its scope of powers and focus, the Environmental Protection Agency is expected to also conduct information campaigns and propagation of information on renewable sources, for example with respect to the support thereof within the grant programmes.

Summary of existing and planned measures at regional/local levels (where relevant):

The above (b) are existing measures at national and local levels. See chapter 5.1 table 17;

Planned awareness raising measures, contained within the Renewable Energy Policy, include:

- Raising awareness of the economic and environmental benefits of using RE technologies through public education (TV, radio and other media);
- Development of solar water heaters in institutional facilities, hotels and private households;
- Development of standards for accrediting renewable energy training programmes;
- Training programmes on renewable energy for stakeholders;
- Awareness raising and marketing campaigns aimed at all stakeholders;
- Establishment of a renewable energy information centre or network of centres;
- Development of RE in technical and tertiary curricula;
- Development of RE training institutes and centres of excellence;
- Development of RE Research & Development Action Plan – reduce cost of technology and promote wider application;
- Coordination & co-operation in technology & economic research between Government & private sector;
- Strong linkages between local & international research institutes;
- Development of RE innovations;
- Developing good relationship with media, NGOs & private entities,
- Demonstration & awareness programmes in primary & secondary schools;
- Periodic monitoring & evaluation of RE activities.

Information on supporting measures for use of renewable energy sources in electricity production is made available to all relevant actors (consumers, builders, installers, architects, rural developers, financial institutions and suppliers of relevant equipment). Specific information resources for the different target groups, such as end consumers, builders, installers, architects, farmers, community leaders, rural developers, suppliers of equipment using renewable energy sources, NGOs, public administration. Information campaigns or permanent information centres in the present, or planned in the future.

i. The renewable energy and energy efficiency division will provide detailed information to the communication officer at the Ministry of Energy, whose direct responsibility is to ensure that information is made available through the print and electronic media, website and adverts to all relevant actors;

ii. Information campaigns provided by international partners and MDAs in support of Renewable Energy opportunities.

Person responsible for publishing information on the net benefits, costs and systems using renewable energy sources for electricity and water heating.

The Ministry of Energy and the Electricity and Water Regulatory Commission have a general obligation to provide information, which should include information on renewable energy systems and installations for water heating.

Person responsible for publishing information on the benefits and costs of equipment and systems using renewable energy sources for powering rural microenterprises and homes.

The Ministry of Energy and the Electricity and Water Regulatory Commission, however, have a general obligation to provide information, which should include information on renewable energy systems and installations for powering rural microenterprises and homes.

Guidance for rural developers, microcredit financial institutions, NGOs and agribusinesses provided to help them properly consider the use of renewable energy sources for powering rural microenterprises and homes.

The Director of Energy and Head of Renewable Energy and Energy Efficiency at the Ministry of Energy ensure that the planned measures outlined in c) above will support guidance for rural developers, microcredit financial institutions, NGOs and agribusinesses in the use of RE sources for powering rural microenterprises and homes.

Existing and planned information, awareness raising and training programmes for citizens (women and men) on the benefits and practicalities of developing and using energy from renewable sources. The role of regional and local actors in designing and managing these programmes.

Currently, there are no existing or planned programmes pertaining to information propagation, awareness raising and training for citizens (women and men) regarding the benefits and practicalities of developing and using energy from renewable sources. However, planning measures have been identified in chapter 5.1, table 17, and in this chapter 5.2.4 under points a, c, and e.

Other information campaigns and information propagation regarding renewable sources are organized and conducted by the relevant associations and non-governmental organizations active in the area of renewable energy sources.

5.2.5. Certification for installers of RE equipment

Reference to existing national and/or regional legislation (if any) concerning certification or equivalent qualification schemes for installers of RE equipment

i. There is no legislation concerning certification or equivalent qualification schemes for installers of RE equipment,

ii. However, the RE policy being formulated by the MoE will deal with this aspect.

Body/(ies) responsible for setting up and authorising certification/qualification schemes by 2014 for installers of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems

The Ministry of Energy.

Certification schemes/qualifications.

Currently there are no certification schemes or qualification criteria in place.

Publicly available information on these schemes. Published lists of certified or qualified installers.

i. Information on these schemes is currently not available;

ii. Certification and qualification systems for inspections of small-scale biomass boilers and stoves, solar photovoltaic and solar thermal systems should be publicly available as part of a "testing code" published on the Ministry of Energy's website. This website should also comprise a list of persons authorised to carry out these activities and may be searched by name, region and specialisation;

iii. The RE policy, which is currently in the formulation process, will define the person authorized to carry out the installation using energy from renewable sources.

Summary of existing and planned measures at regional/local levels (where relevant).

See d).

Standards governing the design, installation and performance of renewable energy systems shall be developed together with a certification process to verify that systems meet these standards.

5.2.6. Electricity infrastructure development

Reference to existing national legislation concerning requirements related to the electricity grids:

Below are existing national legislations relating to electricity grids

i. The National Energy Policy, 2009;

ii. The National Electricity Act, 2011;

iii. Electricity and Water Regulation Commission Act,, 2011.

Ensure that transmission and distribution grids will be developed, with a view to integrating the targeted amount of renewable electricity while ensuring and improving the security of the electricity system..

i. The Energy Strategic Plan 2014 and the RE action plan 2014 developed by the Energy Directorate of MoE;

ii. The Electricity and Water Regulatory Body will regulate operation of the distribution network;

iii. The Electricity distribution and supply authority will execute planned distribution network and sell energy to consumers;

iv. The Electricity Generation and Transmission Company will plan and integrate RE sources and operate transmission systems.

The role of information technology tools and storage facilities. Development ensured.

i. The role of SMART grids and SCADA systems are possible tools for managing renewable energy production and for generating up-to-date (on-line) datato ensure maximum productivitywithin the energy mix portfolio. It is also crucial to analyze possibilities of implementing efficient storage of electricity generated from renewable energy sources.

ii. The first steps towards determining the potential for implementing intelligent networks is preparation of a study followed by a decision on the possible introduction of intelligent metering systems.

The reinforcement of the interconnection capacity with neighbouring countries planned.

The Côte d'Ivoire, Liberia, Sierra Leone and Guinea (CLSG) Transmission Line; West Africa Power Pool (WAPP) under the ECOWAS. The proposed CLSG Line will have power dispatch capacity of 80MW for Sierra Leone.

The acceleration of grid infrastructure authorisation procedures addressed. The current state and average time for getting approval. (Please refer to current status and legislation, bottlenecks detected and plans to streamline procedure with timeframe for implementation and expected results.)

i. Grid infrastructure installations are approved by the Ministry of Energy and Board of Directors within the same establishment;

ii. The Municipalities, judiciary, civil society, Lands, Forestry and the Environmental Protection Agency are also involved in the process;

iii. The CLSG – WAPP Line authorization procedures took about five years.

Coordination between grid infrastructure approval and other administrative planning procedures ensured.

Coordination is weak due to the absence of operation and maintenance (O&M) manuals in the newly formed Electricity Distribution and Supply Authority (EDSA) and Electricity Generation and Transmission Company (EGTC). The Electricity and Water Regulatory Commission is mandated by law to administer some level of administrative processes in the electricity business. The improvement of the planning framework is addressed in the National Renewable Energy Policy of Sierra Leone, and in chapter 5.2 of this National Renewable Energy Action Plan.

Priority connection rights or reserved connection capacities provided for new installations producing electricity from renewable energy sources.

There are no priority connection rights or reserved connection capacities provided for new installations producing electricity from renewable energy sources.

Rules for cost sharing between initially and subsequently connected producers. Benefits for subsequently connected producers taken into account.

i. There are no rules for cost sharing between initially and subsequently connected producers;

ii. No experience so far.

How will it be ensured that transmission and distribution system operators provide new producers wishing to be connected with the necessary information on costs, a precise timetable for processing their requests and an indicative timetable for their grid connection?

Need to enact the appropriate legislation or regulation on RES to ensure that happens.

5.2.7. Electricity network operation

The transmission and distribution of electricity from renewable energy sources guaranteed by transmission and distribution system operators. Priority or guaranteed access ensured.

i. Need to develop an operation manual that will guarantee the above;

ii. This should be indicated in the operations manual of the EDSA and EGTC;

iii. The priority and guaranteed access assurance is stipulated in the EWRC.

Ensure that transmission system operators, when dispatching electricity generating installations, give priority to those using renewable energy sources.

i. Need to include in operation manual of EDSA and EGTC;

ii. Also, the EWRC should regulate electricity dispatch from renewable energy sources.

Plants generating electricity from renewable energy sources integrated into the electricity grid.

The 50MW hydropower plant at Bumbuna is connected to the electricity grid by a 161KV transmission line through two (2) step-up 25KVA power transformers.

The rules for charging transmission and distribution tariffs to generators of electricity from renewable energy sources.

The general regulatory rules as outlined in the EWRC apply.

5.2.8. Renewable energy applications for domestic uses

Improved cooking stoves

Standards for improved cooking stoves adopted by the Member State. Implemented at the national level. (legislation planned for implementation; institutional setup)

There is no standard for improved cooking stoves. However there are policy and legislative plans underway and an institution will be set up in the Ministry of Energy with support from the Government technical institute/ renewable energy centre.

Ensure that improved cooking stoves used in the Member State comply with the adopted standard.

The WACCA and ECREEE policies will be harmonized with the Sierra Leone policy on clean cooking in order to ensure that the standard for improved cook stoves complies with the adopted standard.

Efficient charcoal production

Standards and processes for efficient charcoal production adopted by the Member State. Implemented at the national level. (legislation planned for implementation; institutional setup).

There are no standards and processes for efficient charcoal production. However there are policy and legislative plans underway and an institution will be set up in the Ministry of Energy with support from the Forestry Division.

Ensure that charcoal produced in the Member State comply with the adopted standards and processes.

The WACCA and ECREEE policies will be harmonized with the Sierra Leone policy on clean cooking, in order to ensure that the charcoal production standard complies with the adopted standard.

Use of modern fuel alternatives for cooking

Types of policies and strategies exist to promote modern fuel alternatives for cooking (LPG, biogas, solar cookers, and kerosene).

The policies and strategies are enshrined in the formulated renewable energy and energy efficiency policy and the proposed WACCA framework for Sierra Leone.

5.2.9. Biofuels– sustainability criteria and compliance verification

Sustainability criteria for biofuels adopted by the Member State. Implemented at the national level. (legislation planned for implementation; institutional setup.)

There are no sustainable criteria for biofuels. However, biofuel policy is detailed in the renewable energy policy being developed and the institutional setup is in the Ministry of Energy, with support from the Ministry of Agriculture, Forestry and Food Security.

Ensure that biofuels that are counted towards the national renewable target are eligible for financial support with the adopted sustainability criteria. (national institution / body responsible for monitoring / verifying compliance with the criteria)

This issue has been taken into consideration and will form part of the renewable energy policy and strategic measures.

A national authority / body will monitor the fulfilment of the criteria. Does such a national authority / body already exist? Please specify.

The national body that will monitor the fulfilment of the criteria is the energy directorate in the Ministry of Energy.

Compliance with good agro-environmental practices and other cross compliance requirements ensured and verified at national level.

Inter-departmental ministerial coordination activities will be ensured as stipulated in the RE policy.

5.3. Support schemes to promote the use of energy from renewable resources in electricity applied in Sierra Leone.

Regulation for grid connected renewable energy

The legal basis for this obligation/target.

The legislative regulation of the support for use of energy from renewable sources was based on the EWRC Act 2011, which supports electricity generation from renewable energy sources. However, the new act has not modified the conditions for the support of renewable sources in order to achieve a more efficient fulfilment of the binding target of the renewable energy share in gross final energy consumption in Sierra Leone and to increase the share of renewable sources in the consumption of primary energy sources.

Technology-specific targets.

Currently no technology-specific targets have been defined for Sierra Leone.

The concrete obligations/targets per year (per technology).

The NREAP identifies targets set for individual types of renewable sources, and not for particular technologies.

Fulfil the obligation.

For answer, see paragraph (The legal basis for this obligation/target). The obligations and the entity to which they apply are set out in the EWRC Act. 2011, on supported energy sources.

Consequence of non-fulfilment.

For answer, see paragraph (The legal basis for this obligation/target). Upon reaching the targets set out in the action plan in the respective period, the operational support is no longer provided in the next period.

Mechanism to supervise fulfilment.

The Ministry of Energy is authorized to supervise compliance with the EWRC Act No. 2011.

Mechanism to modify obligations / targets.

Some Targets are evaluated within the regular updates of the National Renewable Energy Action Plan (once every two years).

Regulation for rural electrification

The legal basis for this obligation for rural utilities/target for rural electrification.

The National Energy Policy, 2009, Renewable Energy Policy, 2014 and EWRC Act. 2011.

Technology-specific targets? What type of electrification (grid extension, mini-grids or dispersed systems) promoted.

There are no technology-specific targets and all electrification types are considered.

The concrete obligations/targets per year (per type of electrification). Minimum level of electrification.

There are no concrete obligations/targets per year (per type of electrification) and no minimum level of electrification.

Fulfil the obligation.

The EWRC is the responsible authority.

The consequence of non-fulfilment.

This is enshrined in the penalty for defaulters of electricity abstraction or theft sub-section of the EWRC Act. 2011.

Mechanism to supervise fulfilment.

The Ministry of Energy supervises the EWRC compliance.

Mechanism to modify obligations/targets.

Once every two years.

Financial support

The name and a short description of the scheme.

Sierra Leone offers the following type of financial support:

i. Investment support from government consolidated funds for the promotion of renewable energy in the form of duty free concession for imported renewable energy goods and equipment;

ii. Feed-in tariffs for the promotion of renewable energy production.

The projected timeframe for the scheme is from 2015 – 2017.

Is the target grid connected systems or rural off-grid electrification?

The target is for both grid connected systems and rural off-grid electrification.

Management of the scheme. (Implementing body, monitoring authority)

i. The EWRC, which is the regulatory authority, is coordinated and sponsored by the Ministry of Energy. According to the Act, the feed-in tariff is set by the EWRC. The supervisory function is provided by the MoE.

ii. The Ministry of Finance and Economic Development (MoFED) for duty free concession.

Measures taken to ensure availability of necessary budget/funding to achieve the national target.

i. Yearly alignment of the government central budget and the ministry of energy allocated budget and budget review committee in the ministry of finance and economic development for duty free concession and other levies;

ii. For the feed-in tariff scheme, the market operator is entitled to reimburse the costs associated with the support for electricity. A state subsidy is used to cover a portion of these costs.

Long-term security and reliability addressed by the scheme.

The existing scheme does not deal with this aspect.

Periodical revision of the scheme.

The scheme is revised every 2 years.

What kind of feedback or adjustment mechanism exists?

MoE performance tracking mechanism.

Optimization of the scheme.

See EWRC Act, 2011.

Different support according to technology.

The amount of support differs for each renewable energy technology based on project type, energy capacity, cost and funding scheme, location/site (urban or rural), duration, level of coordination and level of government commitment.

The expected impacts in terms of energy production.

With the expected increase in renewable energy production, electricity tariffs are expected to increase by raising the regulated contribution to cover the additional costs associated with the promotion of renewable energy sources. The contribution paid by all electricity consumers will be used to finance the feed-in tariff.

The expected impacts in term of energy access.

Rise in access to renewable energy derived electricity and increase share of renewable power within the energy mix.

Further details of the scheme

Support under the planned scheme is conditional on meeting defined energy efficiency criteria. There are no maximum or minimum sizes for eligible systems, and no regional or local schemes.

Limited measures are already contained in the National Energy Policy 2009, and the EWRC.

The new energy efficiency policy and National Energy Efficiency Action Plan (NEEAP) of Sierra Leone will enable the implementation of energy efficiency measures starting from 2015.

Financial support for investment:

Type of support granted by the scheme (subsidies, capital grants, low interest loans, tax exemption or reduction, tax refunds).

Based on the Finance Act. 2013, the Act made provisions for duty free concession/tax exemption on imported renewable energy appliances and equipment.

Beneficiaries of this scheme (specified for certain technologies).

Applicants interested in renewable energy technologies.

Application procedure.

Presently, applications are continuously received and granted.

Feed-in-tariffs:

The conditions to get the fixed tariff.

See National Electricity Act. 2011 and EWRC Act. 2011. The National Electricity Act. 2011 made provisions for the electricity authority and company to develop tariff structures for the O&M of their entities. The existing tariff structure does not operate a fixed tariff.

Producers have to have a valid licence for electricity generation issued by EWRC, be connected to the system and have a delivery point of the plant registered with the market operator.

Cap on the total volume of electricity produced per year or installed capacity that is entitled to the tariff.

The entitlement to the support in the form of the feed-in tariff is limited by the installed capacity:

i. Photovoltaic power plants up to 30 kWp;

ii. RES other than photovoltaic power plants up to 100 kW.

Is it a technology specific scheme? What are the tariff levels for each?

See EWRC Act. 2011.

There are different levels of support for each type of technology, depending on the cost of the technology, in order to guarantee a minimum time of return on the investment. The currently applicable levels of the feed-in tariff should be published on the EWRC Office's website.

Other criteria differentiating tariffs.

See EWRC Act. 2011.

Another criterion is the date of commissioning of the installation into operation, which means that the technical and economic conditions in the period of production installation launch are respected. Other criteria include the type of fuel, in the case of biogas, and method of burning and type of fuel, in the case of biomass, and categorisation according to the installed capacity.

Fixed tariff guaranteed.

See EWRC Act. 2011. The National Electricity Act. 2011 made provisions for the electricity utilities to set their tariff, which is being regulated by EWRC.

Tariff adjustment foreseen in the scheme.

Tariff adjustment is regulated in the EWRC Act. 2011.

The feed-in tariff for production installations should be calculated on an annual basis, taking into account current investment costs and, in the case of biomass, biogas and bioliquids, also the current fuel prices.

Tendering:

Frequency and size of the tenders.

There is no specific frequency and size for the tenders.

The state authorities do not place tenders for the construction of technologies for the production of electricity from renewable sources. Tenders, if any, are placed only upon the request of an investor of such a construction project.

Technologies specified.

Technologies and conditions for tendering differ depending on the specific tender.

Integration with grid development.

As part of the permit for the construction of a renewable energy production technology, the operator (or future operator) has to obtain, prior to the initiation of the construction, the consent or preliminary consent of the electricity grid operator concerning connection to the electricity grid. Based on the application for connection to the electricity grid, the transmission or distribution system operator will analyse the requirements for future development of the system and draft its investment plan for the development and enhancement of the system.

Rural electrification:

Financial support schemes for rural electrification programmes.

There is financial support from government and donor partners for all energy projects including rural electrification and renewable energy. This forms part of government support and donor partners' support towards sustainable development.

Special financial support schemes for the use of RE in rural electrification programmes.

No special financial support scheme exists for the use of RE in rural electrification programmes.

Obligation to provide energy access with renewable energy sources.

The Ministry of Energy is the body responsible to provide energy access with renewable energy sources, through the Electricity Act 2011, Energy Policy 2009 and the electricity and water regulatory commission act 2011.

Obligation.

The National Energy Policy 2009, Renewable Energy Policy 2014, and EWRC Act. 2011.

5.4. Specific measures for the promotion of efficient cook stoves.

Initiated projects specific to clean cooking in Sierra Leone are as follows:

- GEF project by UNDP titled: Energy efficient production and utilization of charcoal through innovative technologies and private sector involvement in Sierra Leone - this programme is an effort to increase efficiency in charcoal production and cook stove production;
- Support to the Sierra Leone Ministry of Energy with the preparatory phase of a household cooking energy plan Supported by: European Union Energy Initiative Partnership Dialogue Facility (EUEI PDF), CAMCA Clean Energy; Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) (March, 2013);
- Project titled "Improved Cooks toves" the group GERES from Mali have tested the efficiencies of locally produced cook stoves in Sierra Leone, at the GTI Renewable Energy Centre, Kissy Dockyard;

- Sierra Leone cook stove training in 2010 and Sierra Leone ELSA stove training in 2012 by Bebi Project (the Power of Biochar), in collaboration with CORD – SL and Njala University, Sierra Leone.

Furthermore, the University of Sierra Leone, namely Fourah Bay College and Njala University including the Government Technical Institute (Renewable Energy Centre), in collaboration with MoE, are the existing institutions managing the programmes of clean cooking and are interested in clean cooking promotion.

Specific measures to promote efficient cook stoves:

i. Establish and operationalize a cooking energy development centre, equipped to test and certify improved cook stoves according to international standards;

ii. Provide public education and awareness campaigns, through gender-based knowledge products, to support public and private stakeholders;

iii. Introduce new technologies for improved cook stoves and phase out obsolete technologies and inefficient cook stoves, through the Monitoring, Verification and Enforcement programme;

iv. Develop and adopt national cook stove policies, strategies and targets, including legal and regulatory mechanisms in line with the existing ECOWAS regional policies;

v. Support cross-sectoral coordination, through the inclusion of clean cooking across sectors, e.g. through inter-ministerial task teams;

vi. Establish standards and labelling for improved cook stoves, in accordance with international bodies (such as the Global Alliance for Clean Cook Stoves);

vii. Carry out information dissemination and knowledge sharing (e.g. catalogue of best practices and strategies, information materials on clean cook stoves, awareness raising campaigns and capacity building workshops; programmes for dissemination and sensitization of the public about the adopted standards and labels);

viii. Introduce programmes to enhance access to finance, increase the use of carbon financing;

ix. Ensure accurate and reliable cook stove data collection for conducting detailed cost-benefit analysis on the opportunity cost of improved cook stove solution;

x. Strengthen the Ministry of Energy to translate cook stove plans and strategies into pragmatic sultions, suitable for business;

xi. Introduce viable business and financial models with cost efficient incentives to scale up efficient cook stove business;

xii. Mobilise private investment and encourage involvement of the private sector and banks in funding sustainable cooking energy investment projects;

xiii. Improve technical skills to add value to the improved cook stove supply and demand business;

xiv. Ensure that metal sheeting prices are monitored and stabilized to avoid escalation;

xv. Ensure access to quality clay molds, as this is a major bottleneck in the value chain. Clay liners are poorly made and, as a result, break easily;

xvi. Ensure that manufacturers do have sufficient capital to expand production and increase sales of improved cook stoves;

xvii. Introduce a sustainable, independent and efficient control mechanism, including harmonized monitoring and testing protocols.

5.5. Specific measures to promote efficient charcoal production

Charcoal is used mainly in urban areas and considered an improvement compared to firewood by the users. In urban areas, so-called wonder stoves are used to cook with charcoal. In addition to cooking, charcoal is also used for fish smoking in artisanal fishing communities.

Charcoal production is mainly a small-scale, artisanal activity using inefficient earth kilns. Production methods are not standardised or regulated. Production is therefore a fragmented business, with a large number of producers involved. Producers are located in urban and peri-urban areas, but also in more distant rural areas that have access to roads or waterways. The supply and distribution of charcoal to the urban areas involves a large number of traders and middlemen. Although the number of actors involved is large and the sector is poorly regulated and controlled, there are several active charcoal producer and seller associations in Sierra Leone.

Initiated projects specific to charcoal production in Sierra Leone include the recent development of:

- GEF project by UNDP titled: Energy efficient production and utilization of charcoal through innovative technologies and private sector involvement in Sierra Leone - this programme is an effort to increase efficiency in the charcoal production and cook stove production;
- Support to the Sierra Leone Ministry of Energy with the Preparatory phase of a household cooking energy plan supported by: European Union Energy Initiative Partnership Dialogue Facility (EUEI PDF), CAMCA Clean Energy; Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) (March, 2013).

The University of Sierra Leone, namely Fourah Bay College and Njala University including the Government Technical Institute (Renewable Energy Center), in collaboration with MoE, are the existing institutions managing the clean cooking programmes and are interested in clean cooking promotion.

Specific measures to promote efficient charcoal production:

i. Establish a coherent and transparent policy and regulatory framework to stimulate efficient charcoal production by leveraging public and private sector resources;

ii. Carry out public education and sensitization campaigns on charcoal production through gender-based knowledge products;

iii. Improve the efficiency and sustainability of the charcoal production value chain, through participatory and sustainable forest management;

iv. Ensure accurate and reliable baseline data for conducting detailed cost-benefit analysis on the opportunity cost of efficient charcoal production;

v. Provide incentives to manage woodlands better, that appropriate tree species for fuel wood and charcoal are planted, that management to increase yields is applied, that techniques to improve

harvesting to stimulate re-growth or easier replanting are applied.;Minimize kilns' technical inefficiencies that characterizes the entire charcoal production value chain. Charcoal is produced at half or two-thirds of the efficiency it could be were improved techniques and training applied. This results in the harvesting of nearly twice as much wood as necessary to produce the same amount of charcoal as with a well-managed efficient charcoal kiln;

vi. Ensure viable business and financial models with cost efficient incentives to scale up efficient charcoal business;

vii. Develop a national capacity building programme for public and private actors to increase know-how, technical skills on kilns to produce charcoal, with the aim of avoiding considerable wasting of wood, resulting in harvesting more forest than would be necessary if wood-to-charcoal transformation were more efficient;

viii. Establish standards, certification and label on charcoal production and products information for end users to make informed decision on purchase (durability, user friendliness, emission factors):

ix. Increase the level of awareness and capacity on sustainable charcoal production technologies (type of kilns).

5.6. Specific measures to promote modern fuel alternatives for cooking

Alternative fuels such as ethanol, biogas, solar cookers, kerosene and LPG reduce the use of natural resources dramatically and protect women and children from health risks as well. They also benefit the local population by creating new jobs, add value, reduce forest degradation, increase biodiversity and, in the end, people spend less money on wood fuel and have time for productive uses in local jobs and save green resources.

Specific measures to promote modern fuel alternatives for cooking:

i. Study and assess the market for modern fuel alternatives (solar cookers, LPG, biogas, etc.):

ii. Implement programmes and incentive schemes to foster the use of modern fuel alternatives for cooking;

iii. Include modern fuel alternatives in national cooking policies, strategies and targets, including legal and regulatory mechanisms, in line with the existing WACCA ECOWAS regional policies;

iv. Support cross-sectoral coordination, through the inclusion of modern fuel alternatives for cooking across sectors, e.g. through inter-ministerial task teams;

v. Improve the efficiency and sustainability of the modern fuel alternatives for the cooking value chain.

vi. Monitoring system for the modern fuel alternatives for the cooking value chain.

vii. Establish SMEs for distribution of efficient fuels at the local level, and establish public bodies to support and stimulate private sector involvement;

viii. Capacity building programmes for public and private actors, and in collaboration with local communities.

ix. Standards and labelling for modern fuel alternatives for cooking;

x. Information dissemination and knowledge sharing (e.g. catalogue of best practices and strategies, information materials on modern fuel alternatives for cooking, awareness raising campaigns and capacity building workshops);

xi. Programmes of modern fuel alternatives for cooking, to enhance access to finance and increase the use of carbon financing. This includes the mobilization of private investment.

5.7. Support schemes to promote the use of biofuels

The concrete obligations/targets per year (per fuel or technology).

The support schemes to promote the use of biofuels are:

- See the National Energy Policy, 2009;
- See the EWRC Act, 2011;
- See the National Electricity Act, 2011.

Measures to promote the use of biofuels include:

i. Promote the production of biofuels and make the necessary studies to analyse the national/regional supply of feed stock for expansion of the already existing unit; Assess the issues of food security, land concerns, environmental concerns, water and benefits for small farmers and quality control;

ii. Introduce a policy to promote the creation of a market for biofuel production and supply, if sustainable resource is available (also assess development of regional projects). /biofuels obligation;

iii. Introduce a support scheme for large and small biofuel producers.

iv. Define sustainability criteria for biofuels and bioliquids to be implemented at the national level.

v. Identify the national authority/body that is responsible for monitoring the compliance of the biofuels with sustainability criteria and for certification of biofuels.

vi. Ensure harmonization of biofuels policies and strategies with other sector policies and strategies at the national level, as well as with the regional biofuels strategy.

5.8. Specific measures to promote the sustainable use of energy from biomass

Specific measures to promote sustainable use of energy from biomass:

i. Develop educational and outreach programmes to facilitate the general use of new biomass energy technologies.

ii. Promote Research and Development in bioenergy technology, cooking technologies and fuels, and investigate the potential of municipal, agricultural and food industrial wastes to produce energy.

iii. Improve the efficiency and sustainability of the energy value chain through participatory and sustainable forest management (PSFM).

iv. Establish pilot projects for the production of biomass energy conversion devices and systems.

v. Provide adequate incentives to local entrepreneurs for the production of biomass energy conversion systems.

vi. Train skilled manpower and provide basic engineering infrastructure for the local production of components and spare parts for biomass systems.

vii. Implement a monitoring system for the fuel wood value chain regarding species selection and appropriate cutting cycles for effective and sustainable resource management.

viii. Develop appropriate technologies for the utilization of alternative energy sources from fuel-wood.

ix. Develop appropriate and affordable efficient wood stoves and promote the introduction of more resource efficient alternatives, in line with regional/ECOWAS target.

x. Encourage the establishment of private and community wood-lots for supply of fuel-wood in the short-term.

xi. Establish micro-credit facilities for entrepreneurs, especially for women groups, for the establishment and operation of commercial fuel-wood lots and the production of renewable energy devices and systems.

xii. Develop an appropriate pricing structure and feed-in tariffs to encourage substitution of fuel-wood for renewable fuel types.

xiii. Establish training programmes on the use, maintenance and fabrication of efficient wood-stoves and other renewable energy technologies.

xiv. Organize systematic public enlightenment campaigns to address the problems of desertification and soil erosion arising from deforestation.

xv. Disseminate the renewable energy technologies for fuel-wood, through extension programmes, pilot projects etc.

5.8.1. Biomass use (forestry residues, municipal waste, agricultural waste)

Study on biomass (fuel wood) consumption:

<u>The ministry responsible for this calculation and the methodology used.</u>

Ministry of Agriculture, Forestry and Food Security (study by Mr. Conteh 2003 and NGO - Energy for Opportunity

Importance of wood fuel for firewood and charcoal production

Tables 26, 27 & 28 provide wood fuel for firewood and charcoal production used for cooking, heating and lighting, especially for the country's rural and pro-poor population.

Table 26: Projections on wood fuel supply (GWh)

	2010	2013*	2015	2020	2025	2030
Total wood fuel supply (GWh)	14,892	21,972	47,628	56,436	78,888	105,060
Wood fuel supply for firewood (GWh)	13,872	20,364	40,488	45,156	59,172	73,536
Wood fuel supply for charcoal production (GWh)	1,020	1,608	7,140	11,280	19,716	31,524

** or the most recent year for which statistics are available*

Table 27: Projections on wood fuel consumption (GWh)

	2010	2013*	2015	2020	2025	2030
Total wood fuel consumption (GWh)	14,892	21,972	47,628	56,436	78,888	105,060
Wood fuel consumption for firewood (GWh)	13,872	20,364	40,488	45,156	59,172	73,536
Wood fuel consumption for charcoal production (GWh)	1,020	1,608	7,140	11,280	19,716	31,524

** or the most recent year for which statistics are available*

Table 28: Projections on Charcoal imports and exports (GWh)

	2010	2013	2015	2020	2025	2030
Charcoal imports (GWh)	N/A	N/A	N/A	N/A	N/A	N/A
Charcoal exports (GWh)	N/A	N/A	N/A	N/A	N/A	N/A

Note: Charcoal is not imported or exported in Sierra Leone.

5.8.2. Biomass supply

The supply of biomass in Sierra Leone is neither imported nor exported. The domestically available quantity of biomass is sustainable and sufficient for national consumption, based on several studies conducted, a case in point being the recent project preparatory work on efficient production of fuelwood (firewood and charcoal) for Sierra Leone conducted by UNDP.

5.8.3. Measures to increase biomass availability

Mobilisation of new biomass sources:

Biomass from forestry residues:

Degraded land.

38% of 7.16 million ha which is 2.7 million ha.

Unused arable land.

135,000 ha, which is 5% of 2.7 million ha (approximately 38% of total land area), of original forest remains. 20,000 ha are cleared per year, with a deforestation rate of 0.7%.

Measures planned to encourage the use of unused arable land, degraded land, etc. for energy purposes.

The Plan forms part of the RE Policy and RE Action Plan being developed.

Energy use of certain already available primary material (such as animal manure) planned.

The Plan forms part of the RE Policy and RE Action Plan being developed.

Specific policy promoting reforestation.

The Plan forms part of the RE Policy and RE Action Plan being developed

Measures planned to improve forest management techniques in order to maximise the extraction of biomass from the forest in a sustainable way. Forest management improved in order to increase future growth. Measures planned to maximise the extraction of existing biomass that can already be put into practice.See NREP 2014 and NREAP 2014: The Plan forms part of the RE Policy and RE Action Plan being developed.

Biomass from municipal waste

The number of municipal waste facilities

There are about fifteen (15) municipal waste facilities in the Republic of Sierra Leone. Municipal waste is disposed of in landfills.

Measures planned to improve the municipal waste facilities, in order to minimise the environmental impact and maximise the extraction of biogas. Management of municipal waste facilities being improved in order to plan for future growth.

See Renewable Energy Policy, 2014.

Policy or mandate to municipalities to improve municipal waste facilities into landfills.

See National Electricity Act. 2011.

See EWRC Act. 2011.

See National Energy Policy, 2009.

See Renewable Energy Policy, 2014.

Biomass from agricultural waste

Policy or mandate to reuse agro-business waste.

See National Electricity Act. 2011.

See EWRC Act. 2011.

See National Energy Policy, 2009.

See Renewable Energy Policy, 2014.

6. LINK WITH REGIONAL INITIATIVES

The ECOWAS region has a series of on-going regional initiatives on the field of renewable energy:

- The ECOWAS White paper on a regional policy for iIncreasing access to energy services in peri-urban and rural areas by 2015;
- Establishment of ECREEE;
- Adoption of the ECOWAS Renewable Energy Policy (EREP) with targets for 2020 and 2030;
- The ECOWAS Small Scale Hydropower Programme;
- The ECOWAS Solar Thermal Program;
- The ECOWAS Bioenergy Strategy Framework; and
- The ECREEE Rural Electrification Programme.

A summary of these regional initiatives in renewable energy can be found in Annex I of this Plan.

Besides the activities in renewable energy, the ECOWAS region also has a series of on-going activities in energy access:

- The ECOWAS White paper on a regional policy for increasing access to energy services in peri-urban and rural areas by 2015;
- The ECOWAS Revised generation and transmission Master Plan;
- The West Africa Gas Pipeline (WAGP);
- ECOWAS Rural Electrification projects.

A summary of the regional initiatives on energy access can be found in **Annex II.**

Synergies between these regional initiatives and the proposed measures in this Plan will be created.

7. PREPARATION OF THE NATIONAL RENEWABLE ENERGY ACTION PLAN AND FOLLOW-UP OF ITS IMPLEMENTATION

The entire process of developing the NREAP witnessed the involvement of all stakeholders by holding a Kick-off Meeting, two high-level energy task force meetings and two stakeholders' validation meetings including local authorities nationwide. In terms of public consultation carried out to prepare the NREAP, two stakeholder meetings, radio programmes and regional consultative meetings were carried out. The Ministry of Energy of the Republic of Sierra Leone will use the technical committee and steering committee for the implementation of the action plan. The Ministry of Energy's Director of Energy and the Head of Renewable Energy are the national authority responsible for the follow-up of the National Renewable Energy Action Plan. The Ministry of Energy's monitoring and evaluation unit is now charged with monitoring, including indicators for individual measures and instruments, to follow-up the implementation of the NREAP.

ANNEX I - Definition of terms used in the action plan

Agrifuels: Solid biofuels obtained from crops, and residues from crops and other agricultural products. Residues from agricultural production include animal solid excreta, meat and fish residues. Agrifuel is subdivided into bagasse, animal wastes and other biomass materials and residues (check definitions for bagasse, animal wastes and other agricultural residues).

Animal waste: Excreta of animals which, when dry, are used directly as a fuel. This excludes waste used in anaerobic fermentation plants. Fuel gases from these plants are under biogases (see biogas).

Bagasse: the fuel obtained from the fibre which remains after juice extraction in sugar processing

Biofuels: liquid or gaseous fuel for transport produced from biomass.

Other vegetable material and residues: biofuels not specified elsewhere and including straw, vegetable husks, ground nut shells, pruning brushwood, olive pomace and other wastes arising from maintenance, cropping and processing plants.

Solid biofuels: solid fuels derived from biomass.

Liquid biofuels: Liquids derived from biomass and generally used as fuels. Liquids biofuels comprise bio-gasoline, biodiesel and other liquid fuels (definitions of biogasoline, biodiesel and other liquid fuels are provided below).

Bio-gasoline: Liquid fuels derived from biomass and used in spark-ignition internal combustion engines. Common examples are: bioethanol; biomethanol; bio ETBE (ethyl-tertio-butyl-ether); and bio MTBE (methyl-tertio-butyl-ether).

Biodiesel: Liquid biofuels which are usually modified chemically so that they can be used as fuel in engines either directly or after blending with petroleum diesel. Biological sources of biodiesel include, but are not limited to, vegetable oils made from canola (rapeseed), soybeans, corn, oil palm, peanut, or sunflower. Some liquid biofuels (straight vegetable oils) may be used without chemical modification their use usually requires modification of the engine.

Biodiesel as a share of diesel and fuel-oil consumption (in %): The EREP sets conventional biofuels targets (1st Generation Biofuels) for the ECOWAS region as a whole, one of which is the biodiesel as a share of diesel and fuel oil consumption. In this template this is calculated by dividing the production of raw vegetal oil/biodiesel by the diesel oil/DDO/fuel oil consumption in the country.

Straight vegetable oil: When vegetable oil is used directly as a fuel, in either modified or unmodified equipment, it is referred to as straight vegetable oil (SVO) or pure plant oil (PPO).

Other liquid biofuels: liquid biofuels not elsewhere specified.

Biogas: gases arising from anaerobic fermentation of biomass. These gases are composed principally of methane and carbon dioxide and comprise landfill gas, sewage sludge gas and other biogases (check definitions for landfill gas, sewage sludge gas and other biogases). They are used mainly as a fuel but can be used as a chemical feedstock. . It is particularly relevant for cooking purposes or in the context of industrial uses (e.g. breweries, slaughter houses).

Landfill gas: biogas from anaerobic fermentation of organic matter in landfills.

Sewage sludge gas: biogas from anaerobic fermentation of waste matter in sewage plants.

Other biogases: biogases not elsewhere specified including synthesis gas produced from biomass.

Biomass: biodegradable fraction of products, waste and residues from biological origin from agriculture (including vegetal and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste. The uses of biomass for energy are very diverse: from the traditional, low-efficiency burning of wood in open fires for cooking purposes to the more modern use of wood pellets for the production of power and heat, and the use of biodiesel and bioethanol as a substitute for oil-based products in transport.

Base Load: Base load is the level below which electricity demand never drops, i.e. a site with a high maximum demand of 750 kVA whose demand never drops below 250 kVA would have a base load of 250 kVA. Large hydro power is an important renewable energy source for the provision of base load in the ECOWAS region. The significance will grow with the implementation of the WAPP hydropower project pipeline.

Charcoal: The solid residue from the carbonisation of wood or other vegetal matter through pyrolysis. The amount of biomass (usually fuelwood) necessary to yield a given quantity of charcoal depends mostly on three factors:

- *parent wood density – the principal factor in determining the yield of charcoal from fuelwood is parent wood density, since the weight of charcoal can vary by a factor of 2 for equal volumes*
- *moisture content - moisture content of the wood also has an appreciable effect on yields - the drier the wood, the greater is the yield - ; and*
- *the means of charcoal production: charcoal is produced in earth-covered pits, in oil drums, in brick or steel kilns and in retorts. The less sophisticated means of production generally involve loss of powdered charcoal (fines), incomplete carbonization of the fuelwood and combustion of part of the charcoal product, resulting in lower yields.*

Traditional non-efficient charcoal production methods: traditional charcoal production methods include open pits, oil drums and kilns with lower efficiencies. In the ECOWAS charcoal is mainly produced by traditional methods in the informal sector (e.g. open pits and kilns) which are inefficient (60-80% of the energy in the wood is lost) and has impacts on the health and on the environment.

Efficient charcoal production: efficient charcoal is the terminology used on this template for the charcoal produced by modern methods that are more efficient than traditional ones. The modern methods use sealed containers and have higher efficiencies and thus higher yields. Within the EREP, under the targets for domestic cooking, a target for efficient charcoal production is set: 60%/100% of the charcoal production should be by improved carbonisation techniques (yield >25% in 2020 and 2030, respectively. In this template the MS is asked to set out its target and trajectory for efficient charcoal production. This is calculated by dividing the quantity of charcoal produced by improved carbonisation techniques with yield superior to 25% in tonnes by the total charcoal production in tonnes.

Conservation: The reduction of energy usage through increased efficiency and/or reduced waste.

DDO: stand for Distillate Diesel Oil

Distributed and Microgeneration: This is when electricity is generated for local distribution and is not connected directly to the national grid. Microgeneration is typically used to describe smaller scale generating technology.

Energy Efficiency appliances: Electrical devices or appliances that perform their task, and use less electricity than lower-efficient devices. Electrical inefficiency in many devices is directly related to the heat they produce. For example, energy efficient light bulbs use most of the incoming electrical energy to produce light, not heat. Inefficient air conditioning is a major cause of peak hours in the ECOWAS region.

Electricity: The transfer of energy through the physical phenomena involving electric charges and their effects when at rest and in motion. Electricity can be generated through different processes: e.g. by the conversion of energy contained in falling or streaming water, wind or waves or by the direct conversion of solar radiation through photovoltaic processes in semiconductor devices (solar cells); or by the combustion of fuels.

Electricity demand: The total electricity consumption in GWh or MWh consumed by a country annually. This includes the demand of the complete system including the in circuital consumption and the losses.

Electricity mix: The range of energy sources of a region/country (either renewable or non-renewable) that is used to produce electricity.

Energy access: A universal and affordable access to modern means of energy. It implies access to modern cooking solutions defined as relying primarily on non-solid fuels for cooking. It also implies access to electricity, defined as availability of an electricity connection at home or the use of electricity as the primary source of lighting that can provide non-served communities and households with a modern life and economic development.

Energy Efficiency: The ratio of performance or output of performance of services, goods or energy to input of energy. The energy efficiency of a process is improved if it produces the same service using less energy. Energy-efficient light bulbs produce the same amount of light but use up to 75% less energy to do so. Improving energy efficiency helps reducing energy use or bringing more energy services with the same amount of energy consumed.

EREP: ECOWAS Renewable Energy Policy

Ethanol: also called ethyl alcohol, pure alcohol, grain alcohol or drinking alcohol, is a volatile, flammable, colourless liquid that can be used for several different purposes, being one of them as fuel. As fuel, ethanol is used as a motor fuel and fuel additive (e.g. Brazil relies in Ethanol as a motor fuel). Ethanol is also used for household heating as a relatively safe fuels.

Ethanol as share of gasoline consumption: The EREP sets first generation biofuels targets for the ECOWAS region as a whole, one of which is the ethanol as a share of the gasoline consumption. This is calculated by diving the quantity of ethanol produced by the quantity of gasoline consumed in the country and it is show in %.

Fossil Fuel: An energy source formed in the Earth's crust from decayed organic material. The common fossil fuels are oil, diesel, coal, and natural gas. Some ECOWAS countries are highly dependent on diesel electricity generation.

Fuelwood, wood residues and by-products: fuelwood or firewood (in log, brushwood, pellet or chip form) obtained from natural or managed forests or isolated trees. Also included are wood residues used as fuel and in which the original composition of wood is retained. In the ECOWAS region fuelwood is the principal source of energy for cooking and heating, however statistics on fuelwood are generally poor as it is mainly produced and traded in the informal sector.

Grid-connected: a system (photovoltaic, hydro, diesel, etc.) that is connected to a centralised electrical power network (power grid).

Generation (electricity): This covers the production of electricity at power stations.

Heat: Heat is an energy carrier primarily used for warming spaces and industrial processes

Hybrid System: a power system consisting of two or more power generating subsystems (e.g. combination of a wind turbine or diesel generator and a photovoltaic system)

Improved cookstoves (also called clean/efficient cookstoves): is a device that is designed to consume less fuel and save cooking time, convenient in cooking process and creates smokeless environment in the kitchen or reduction in the volume of smoke produced during cooking against the traditional stove; and thus addressing he health and environmental impacts associated with traditional cookstoves. Traditional cookstoves (open fires and rudimentary cookstoves using solid fuels like wood, coal, crop residues and animal dung) are inefficient, unhealthy, and unsafe, and inhaling the acrid smoke and fine particles they emit leads lead to severe health problems and death. Traditional cookstoves also place pressure on ecosystems and forests and contribute to climate change through emissions of greenhouse gases and clack carbon. Within the EREP targets are set for improved cookstoves, as the pressure on the ECOWAS woodland will grow exponentially. Thus the policy includes the banning of inefficient stoves after 2020, enabling 100% of the population of the urban areas to use high efficient wood and charcoal stoves (with efficiencies higher than 35%) from 2020 onwards and 100% of the rural population to use high efficient charcoal stoves from the same date on. In this template the MS is asked to set a target for improved cookstoves measured in terms of the % of the population that uses efficient cookstoves. This is estimated by dividing the number of inhabitants that use improved cookstoves by the total number of inhabitants of the country.

Installed capacity: is the rated continuous load-carrying ability of a given electricity generation plant expressed in megawatts (MW) for active power

Kilowatt (kW): 1,000 watts

Kilowatt-hour (kWh): 1,000 watt-hours.

LPG: Liquefied petroleum gas

Load: In an electrical circuit, any device or appliance that uses power (such as light bulb or water pump)

Megawatt (MW): 1,000,000 watts

Megawatt-hour (MWh): 1,000,000 watt-hours

Mini-grids: set of electricity generators and, possibly, energy storage systems interconnected to a distribution network that supplies the entire electricity demand of a localized group of customers. This power delivery architecture can be contrasted with single customer systems (e.g. solar home systems) where there is no distribution network interconnecting customers, and with centralized grid systems, where electrical energy is transmitted over large distances from large central generators and local generators are generally not capable of meeting local demand. Mini-grids are particularly relevant in the rural context of ECOWAS where renewable energy powered hybrids can be the more cost-effective alternative. The EREP includes mini-grid targets.

Modern fuel alternatives (for cooking): known as non-conventional or advanced fuels, these are any materials or substances that can be used as fuels for cooking, other than conventional solid fuels such as coal, fuelwood and charcoal. These alternatives cover Liquefied petroleum gas (LPG), biogas, ethanol, solar power (e.g. solar cookers) and kerosene. In this template improved cookstoves are not considered within the modern fuel alternatives, as they are object of a separate analysis in this template.

Non-technical losses: in electricity distribution include mainly electricity theft, but also losses due to poor equipment maintenance, calculation errors and accounting mistakes. Non-Technical losses are caused by actions external to the power system or are caused by loads and condition that the Technical losses computation failed to take into account. Non- Technical losses are more difficult to measure because these losses are often unaccounted for by the system operators and thus have no recorded information. A reduction of the losses can contribute considerably to the improvement of energy security in many ECOWAS countries.

Offshore wind: wind projects installed in waters off the coast.

Onshore wind: Wind farms installed on land.

Operating costs: the costs of using a system. For fuel-based systems these costs include all fuel costs over system lifetime.

Off-grid applications: is a designation for facilities that produce all their own energy and are not connected to any external source, such as the electrical power grid.

Peak Load: maximum value of necessary capacity to face peak demand. In terms of this template, peak load is characterised for a given year in MW (this includes the load of the complete system including the in circuital consumption and the losses).

Photovoltaic (PV) system: a complete set of interconnected components for converting sunlight into electricity by photovoltaic process, including array, balance-of-system components, and the load.

Power grid: a system of high-tension cables by which electrical power is distributed throughout a region

Renewable Energy (RE): 'Renewable energy' is used to describe the energy produced using naturally replenishing resources. This includes solar power, wind, geothermal, bioenergy, wave and tide and hydropower.

Renewable energy sources – in this template the renewable energy sources refer to the following renewable energy technologies:

- *Hydropower which includes:*
    - *Small scale hydropower (small-hydro or SSHP) up to a maximum installed capacity of 30 MW;*
    - *Medium (capacity between 30MW and 100MW) and large hydropower (capacity higher than 100MW);*

  In the EREP hydropower is defined as follows: up to 30 MW small-scale, 30 to 100 MW medium-scale, more than 100 MW large-scale.

- *Bio-energy covering three different fields:*
    - *Woodfuels (firewood and charcoal) used for domestic cooking purposes and commercial applications (restaurants, breweries, potteries, blacksmiths, brick makers). Excess woodfuels resources could be used for power generation with other biomass.*
    - *By-products from crops production for power generation (stalks, straw, husks, shells, kernels, etc.). These can serve as fuel for power generation when gathered together on an agro-industry site. Power can also be generated through biogas production using industrial or urban waste, manure and dung (resource concentration at dairies or slaughter houses or cattle and vegetable markets).*

- *Energy crops for power generation or sustainable biofuels (e.g. jatropha) offer some interesting perspectives. EREP considers 2nd generation biofuels which do not compete with food crops for available land, and comply with the following minimum criteria; lifecycle GHG reductions, including land use change and social standards.*

- *Wind energy (on-grid and off-grid applications);*
- *Solar: PV, Concentrated Solar Power (CSP) and solar thermal water heating.*
- *Tide, wave and ocean and geothermal, although not considered in the EREP as renewable energy options, were included on the template as some of the countries have available potential for its use for generation of energy.*
- *Geothermal*

Renewable energy share in the electricity mix: - is the share of renewable electricity generation in the total electricity generation for a given year, measured in %. This is calculated in the template by dividing the electricity production from renewable energy sources (in MWh/year) by the total electricity production (in MWh/year) – renewable and non-renewable for the same year.

Rural Electrification: Provides a regular supply of electricity to rural residents. It implies the extension of power lines to rural areas, or the use of stand-alone, mini-grids or isolated power systems. The EREP includes targets for rural electrification.

Rural Population as referred for off-grid applications (mini-grids and stand-alone systems): Following EREP's definitions, it refers to the population for which the mini-grid and decentralised supply systems apply.

Share of rural population served with off-grid (mini-grids and stand-alone) renewable energy electricity services: this is the percentage (%) of the rural population as defined above that is served with mini-grids and stand-alone system. This is calculated by dividing the number of inhabitants served by off-grid applications by the number of rural inhabitants (as defined above).

Rural communities: These includes population living in rural centres and villages with population between 200 and 2,500 inhabitants and some larger cities that due to its peripheral geographical location are away from the national grid. The EREP refers as well that some of the off-grid rural localities supplied before 2020 might be included in the grid extension as they will potentially grow up.

Solar cookers: or solar oven, is a device which uses the energy of direct sun rays (which is the heat from the sun) to heat, cook or pasteurize food or drink.

Solar thermal water heating: or solar hot water (SHW) systems comprise several innovations and many mature renewable energy technologies that have been well established for many years. In these systems water is heated by the sun using collectors. These systems are designed to deliver hot water for most of the year. They can contribute to the reduction of peak hours in the urban context. Moreover, they can be an effective tool to save energy costs in hotels, hospitals and industrial processes (e.g. beverage industry)

Stand–alone power systems (SAPS): also known as remote area power supply, is an off-the-grid electricity system for locations that are not fitted with an electricity distribution system. Typical SAPS include one or more methods of electricity generation, energy storage, and regulation.

Support scheme: means any instrument, scheme or mechanism applied by a Country or group of Countries, that promotes the use of energy from renewable sources by reducing the cost of that energy, increasing the price at

which it can be sold, or increasing, by means of a renewable energy obligation or otherwise, the volume of such energy purchased. This includes, but is not restricted to, investment aid, tax exemptions or reductions, tax refunds, renewable energy obligation support schemes including those using green certificates, and direct price support schemes including feed-in tariffs and premium payments.

Some support schemes for renewable energy:

- *Production based incentives:*
    - *Feed-in-Tariff ("FIT"): is an energy supply policy that promotes the deployment of renewable energy resources. A FIT offers a guarantee of payments to renewable energy producers for the actual electricity produced ($/kWh). These payments are generally awarded as long-term contracts.*
    - *Quota system: is an energy supply policy that awards the generator with certificates that can be sold into a market (with no price guarantee)*
    - *Quota systems with competitive bidding: is the fixation of mandatory production quotas for green electricity supply. These quotas are imposed on power generating utilities and / or electricity distribution utilities (calculated as a percentage of production/sales). Operators can meet these obligations in three ways: (i) by producing their own green electricity, (ii) by buying the electricity under long term contracts, and (iii) by acquiring on the financial market the "Green Certificates" corresponding to the amount of electricity required.*
    - *Decentralized quota system with green certificate market also called tradable green certificates (TGC): is the fixation of mandatory production quotas for green electricity supply. These quotas are imposed on power generating utilities and / or electricity distribution utilities (calculated as a percentage of production/sales). Operators can meet these obligations in three ways: (i) by producing their own green electricity, (ii) by buying the electricity under long term contracts, and (iii) by acquiring on the financial market the "Green Certificates" corresponding to the amount of electricity required.*
- *Investment based incentives*
    - *Capital grants and loans: investment instruments in which government provide grants or loans for the development of renewable energy projects. Grants do not have to be repaid, while loans have to be repaid.*
    - *Microcredits: is the extension of very small loans (microloans) to impoverished borrowers who typically lack collateral, steady employment and a verifiable credit history.*
    - *VAT Exemptions: allows households or investors not to have to pay VAT on renewable energy or energy efficiency equipment*

Tidal And Wave (marine generation): The principle behind tidal generation is similar to wind turbines, except that instead of wind turning the turbine blades, the process uses underwater current caused by tides. One of the benefits of tidal power over wind power is the predictability of tidal currents, enabling the developers to know exactly when the turbines will be producing power. Electricity can also be generated by harnessing the energy waves. The aim is to capture the vertical movement in the water surface caused by waves and to convert that energy to electricity by turning a generator.

Technical losses: Losses in power system that are caused by the physical properties of the components of the power system. Technical losses are naturally occurring losses (caused by action internal to the power system) and consist mainly of power dissipation in electrical system component such as transmission lines, power transformers, measurement system, etc.

Watt-hour (Wh): a measure of electric energy equal to the electrical power multiplied by the length of time (hours) the power is applied.

Waste: in energy statistics waste refers to the part of the waste that is incinerated with heat recovery at installations designed for mixed wastes or co-fired with other fuels. The heat may be used for heating or electricity generation. Certain wastes are mixtures of materials of fossil and biomass origin.

Industrial waste: non-renewable waste which is combusted with heat recovery in plants other than those used for the incineration of municipal waste. Examples are used tires, specific residues from the chemical industry and hazardous wastes from health care. Combustion includes co-firing with other fuels. The renewable portions of industrial waste combusted with heat recovery are classified according to the biofuels which best describe them.

Municipal waste: Household waste and waste from companies and public services that resembles household waste and which is collected at installations specifically designed for the disposal of mixed wastes with recovery of combustible liquids, gases or heat. Municipal wastes can be divided into renewable and non-renewable fractions.

Wind power: The conversion of energy in the wind into electrical power using a wind turbine. Wind farms can be sited on land or at sea, with those offshore able to take advantage of the much stronger and consistent winds found off the coast.

ANNEX II – REGIONAL INITIATIVES IN RENEWABLE ENERGY

The ECOWAS White Paper on Increasing Access to Energy Services in Peri-Urban and Rural Areas by 2015

The ECOWAS White Paper was adopted in 2006 by the ECOWAS Heads of States and Government in recognition of the key role that energy plays in the achievement of the Millennium Development Goals (MDGs). The White Paper aims to provide access to improved domestic cooking fuels and sustainable electricity services for the majority of the population by 2015. Moreover, it foresees that at least 20% of new investments in electricity generation should originate from locally available renewable resources, in order to achieve self-sufficiency, reduced vulnerability and sustainable environmental development.

The ECOWAS Energy Protocol

The ECOWAS Energy Protocol is a legal text that formalises the juridical framework of enterprises in the energy sector that was modelled after the European Energy Charter Treaty. It promotes investment and trade by serving as a security for foreign direct investments in the energy sector. The ECOWAS Member States have completed the process of ratifying the Protocol which aims to provide a legal and regulatory framework for all regional energy integration initiatives and projects

The ECOWAS Bioenergy Strategy Framework

The ECOWAS Bioenergy Strategy Framework, adopted by the ECOWAS Council of Ministers in June 2013, aims to enhance the sustainable Bioenergy production and use within the Region that help address energy poverty, particularly in the rural and peri-urban populations, promotes food security, safeguard the environment, and enabling domestic and foreign investments. Development of National Action Plans should take into consideration the following objectives and initiatives:

- Universal access to modern energy services, especially in the rural and peri-urban areas by 2030 ;
- A more sustainable and safe provision of domestic energy services for cooking thus achieving the objectives of the White Paper for access to modern energy services by 2020 and
- Increasing food security within the region.
- Promote the transition from the traditional use of biomass towards a modern, efficient production and use of modern Bioenergy;
- Broaden regional dialogue and peer-to-peer learning to support the development of Bioenergy strategies in the ECOWAS Member States ;
- Promote regional policy planning for Bioenergy harmonized with national policies;
- Sensitize and share experiences on modern sustainable Bioenergy production that also promotes food security; and
- Create a vibrant and sustainable modern Bioenergy sector that promotes economic growth, rural development, and poverty alleviation.

The ECOWAS Small-Scale Hydropower Program

THE ECOWAS Small-Scale Hydropower Program, adopted by the ECOWAS Council of Ministers in June 2013, aims to contribute towards increased access to modern, affordable and reliable energy services by establishing an enabling environment for small-scale hydro power investments and markets in the ECOWAS region.

Between 2013 and 2018 the following specific program objectives will be achieved:

- At least six ECOWAS countries will have improved their legal framework (poverty reduction impact of SSHP evidence in their legal framework, feed-in tariff defined, transparent licensing procedure etc.);
- ECOWAS Member States integrate SSHP into their scenarios, planning documents and budgetary allocations;
- National SSHP initiatives and projects increasingly rely on local expertise from public and private sector (with limited international support). At least 1000 experts are trained.
- Quality guidelines are in use and quality of SSHP project proposals and feasibility studies improved.
- SHPP, planning tools and all other SHPP related publications are available on the ECREEE website.
- A least 35 additional SSHP projects per year are developed up to feasibility study level. The construction of 50 projects has commenced. The more funding is mobilized the more projects can be developed.
- At least 10 companies established to provide various SSHP related services (planning, operation, repair etc.).
- Sustainability criteria and biodiversity offsetting will be mainstreamed throughout the planning and construction of SHP plants.

ECREEE Rural Electrification Programme (ERuEP)

The implementation of ERuEP will be done based on the four main pillars of ECREEE work programmes:

- Policy support (P);
- Capacity development (C);
- Project Development and Financing (D);
- Knowledge management (K).

These four pillars are vastly interlinked, and their importance for programme development in ECREEE is that, it allows for planning to take into account all the aspects needed for a successful implementation. A feasible initiative must include policy mechanisms, capacity building initiatives, promote the development and financing of specific projects and appropriate knowledge management, starting with awareness raising and knowledge sharing.

The main activities to be undertaken in the rural electrification initiative include:

1 **Support Member States in setting up the enabling environment and institutional framework for Mini-grids.**

- Support MS in analysis and planning of rural electrification through GIS based rural electrification planning
- Support the identification of national tailored approach to rural electrification
- Support the establishment of appropriate institutional and legislative framework
- Promote an enabling environment for private sector involvement
- Promote regional policy on rural electrification

2 Strengthen the capacities on sustainable management, operation and maintenance of existing systems

- Technical and entrepreneurial training to build capacity on local manufacturing of components
- Mentorship to entrepreneurs
- Support project preparatory activities
- Support governments in fund mobilisation
- Direct support to implementation through EREF calls

The ECOWAS Programme on Gender Mainstreaming in Energy Access (ECOW-GEN)

The ECOWAS Programme on Gender Mainstreaming in Energy Access (ECOW-GEN) was established against the background that women's potential, in the ECOWAS region, as producers and suppliers of energy services is under-utilized and that empowering women to make significant contributions in the implementation of the adopted regional renewable energy and energy efficiency policies is necessary for the achievement of the Sustainable Energy for All (SE4ALL) goals in West Africa. Moreover, the programme is founded upon the principles of the ECOWAS Gender Policy which emphasizes the "need to develop policies and programmes to provide alternative energy sources which would contribute to women's health and also alleviate their time burden".

To stimulate the development of women-led business initiatives in the energy sector, ECREEE, through the support of the Spanish Agency for International Cooperation and Development (AECID), established the ECOWAS Women's Business Fund. ECREEE will work with Member States to identify and support, through the fund, innovative energy projects implemented by women groups and associations. In addition to this, ECREEE will assist Member States to establish similar funds in their respective

The ECOWAS Solar Thermal Program

The overall goal of the Solar Thermal Program (SOLTRAIN) in West Africa is to contribute to the switch from a fossil fuel based energy supply to a sustainable energy supply system based on renewable energies in general but based on solar thermal in particular. The overall project will be coordinated by ECREEE and technically implemented by AEE INTEC in cooperation with 8 institutional project partners from 7 West African countries (Cape Verde, Nigeria, Burkina Faso, Ghana, Mali, Senegal, Niger and Sierra Leone).

The ECOWAS solar thermal capacity building and demonstration program therefore aims to remove existing awareness, political, technological, and capacity related barriers which restrict solar thermal energy deployment in ECOWAS countries. The program will also contribute to increase the grid stability and save national power reserves as solar thermal systems will significantly reduce the stress on electric grids due to the shift from electricity to solar energy. The program links precisely to the goals of the regional polices on Renewable energy and energy Efficiency adopted by the ECOWAS Authority of Heads of State and Government in 2013. The regional policies considered solar thermal as a least cost sustainable energy technology and set specific targets for its use to meet sanitary and industrial hot water needs in the region.

The goals of SOLtrain West Africa are:

- Capacity Building by theoretical and practical Train-the-trainer courses to selected universities and polytechnic schools in the area of solar water heating and solar thermal drying
- Identify, monitor, analyze and improve existing solar thermal systems together with the partner institutions (practical training).
- Technical support of local producers.
- Design and Install solar thermal systems on the partner institutions for teaching and demonstration purposes.
- The partner institutions will offer trainings to national companies, installers, producers and further training institutions within their countries.
- Installation of 200 Demonstration systems at social institutions as schools and hospitals engineered by the partner institutions and installed by national practitioners
- Trainings to administrative, political and financial stakeholders in each country
- Solar thermal testing facility in one of the countries

The ECOWAS GENERATION AND TRANSMISSION MASTER PLAN

The ECOWAS Renewable Energy Policy highlights renewable energy scenario that is fully complementary to the ECOWAS power supply strategy and conventional national supplies, both as a significant contribution to bulk power generation and as a prevailing contribution to universal energy access for rural areas. Projects to be developed under the renewable energy power generation are to be implemented by ECREEE.

The ECOWAS Generation and Transmission Master plan approved in September 2011, foresees 30 power generation projects selected as regional priority power projects with a total capacity of 10.3 GW and a cost of US$18 billion (€15 Billion). The major share of this new generation and transmission capacities is projected to be available from 2017 to 2019. The selected projects are based primarily on large hydro power (21) with 7,093 MW, on natural gas (3) with 1,300 MW, on coal (2) with 1,075 MW and on renewable energy (4) with 800 MW. It must be noted that some projects are already getting delayed, and, therefore, the proposed scenario will most likely not happen as scheduled. This would have serious consequences for the importing countries and countries relying on new large hydro. In this context, RE technologies might assume more competitive roles.

The tables below show the lists of projects (generation and transmission) earmarked for regional implementation or as a regional priority projects:

Table 29: REGIONAL PRIORITY GENERATION PROJECTS

Regional Project	Priority Capacity	Annual Energy Generation	Generation Cost	Year of Project Commissioning
Coal Power plant in Sendou-(**Senegal)**	875MW		2532 Million US $	2016
Gouina Hydroelectric Project: Interconnecting Kayes **(Mali)-**Tambacounda **(Senegal)**	140 MW	565 GWh	329 Million $	2017
Wind Farm(**Senegal-the Gambia)**	200 MW		318 Million $	2021
Hydroelectric plants of Boureya (OMVS) – Badoumbé (OMVS) – Balassa (OMVS) and Koukoutamba (OMVS) 1. Badoumbé 2. Balassa 3. Boureya 4. Koukoutamba (**Mali**)	 70 MW 181 MW 160 MW 281 MW	 410 GWh 401 GWh 455 GWh 455 GWh	 197 Million $ 171 Million $ 373 Million $ 404 Million $	 2017-2019 2017-2019 2021 2019-2021
Kaléta Hydro **(Guinea**)	240 MW- 3 x 80 MW	946 GWh	267 Million $	2015
Sambangalou Hydro (**Guinea**)	128 MW- 4 x 32 MW	402 GWh	433 Million $	2017
Digan Hydro (**Guinea**)	93.3 MW	243 GWh	112 Million $	2012
Souapiti Hydro (**Guinea**)	515 MW	2518 GWh	796 Million $	2017-2019

Amaria Hydro(**Guinea**)	300MW	1435 GWh	377 Million $	2019-2021
Grand Kinkon Hydro (**Guinea**)	291MW	720 GWh	298 Million $	2012
Kassa Hydro **(Guinea/Sierra Leone)**	135 MW	528 GWh	214 Million $	2019-2021
Mount Coffee Hydro (**Liberia**)	66 MW	435GWh	383 Million $	2015
Bumbuna Hydro(**Sierra Leone**)	400 MW – 1560GWh – 520 M$	1560 GWh	520 Million $	2017-2019
Félou Hydro **(Mali)**	60 MW	350GWh	170 Million $	2013
Solar project 150 MW **(Mali)**	150MW - 549 M$		549 Million $	2019-2021
Tiboto Hydro **(Cote d'Ivoire)**	225 MW	912 GWh	578 Million $	2021
Fomi Hydro (**(Guinea)**	90 MW	374 GWh	156 Million $	2017-2029
Soubré Hydro **(Côte d'Ivoire)**	270MW	1120 GWh	620 Million $	
Aboadze- combined cycle Thermal Plant (Ghana)	400 MW		356 Million $	2014
Hydro **Adjaralla (Togo)**	147 MW	366 GWh	333 Million $	2017
Project of combined cycle Thermal (**Togo)**	450 MW		401 Million $	2021
Project of thermal plant in Maria Gleta **(Benin)**	450 MW		401 Million $	2014
Solar project 150 MW **(Burkina Faso)**	150MW		549 Million $	2017-2019
Mambilla Hydro	2600MW	11214 GWh	4000 Million $	2019-2021

(Nigeria)				
Zungeru Hydro **(Nigeria)**	700 MW	3019 GWh	1077 Million $	2017-2019
Wind Farm 300 MW **(Nigeria)**	300 MW		477 Million $	2021
Coal plant of Salkadamna **(Niger)**	200 MW		573 Million $	

Table 30: REGIONAL PRIORITY TRANSMISSION AND INTERCONNECTION PROJECTS

Project	Length of Transmission line	Cost of project	Commissioning Year
Hydroelectric plant Gouina: 225 kV OMVG loop	280 km	65 Million $	2019
225kV OM VG double circuit loop Linsan (Guinea) -Manantali **(Mali**) Reinforcement of Manantali-Bamako-Sikasso (**Mali**) section		131 Million $ 151 Million $	1st circuit: 2017-2019; 2nd circuit: 2019-2021
225kV OM VG loop Bolgatanga (**Ghana**) – Bobo Diolasso (**Burkina**)- Bamako (**Mali**)	742 Km	230 Million $	2015
225 kV OMVG loop between Senegal, The Gambia, Guinea-Bissau.	1677 Km	576.5 Million $	2017
Grand Kinkon western section of OMVG loop		141 Million $	2012
CLSG 225kV OMVG double circuit loop.	1060 km	430 Million $	2015
Second circuit of CLSG line 225kV OMVG loop	1060	69 Million $	2017-2019
225kV OMVG loop Ségou (**Mali**) - Ferkessédougou (**Ivory Coast**)	370 km	175 Million $	2012

225kV OMVG loop Buchanan (**Libéria**) –San Pedro (**Ivory Coast**)	400 km	100 Million $	2019-2021
225kV OMVG loop Linsan-Fomi – Fomi-Nzerekoré – Fomi-Bamako	1350 km	550 Million $	2017-2029
225kV OMVG double circuit loop Fomi (**Guinea**) – Boundiali (**Ivory Coast**)	380 km	111 Million $	2019-2021
225kV OMVG loop Soubré-Taabo (**Ivory Coast**)	196 km	69 Million $	2017-2019
225kV OMVG loop Bolgatanga (**Ghana**) – Ouagadougou (**Burkina Faso**)	206 km	74 Million $	2013
330kV OMVG loop between **Prestea** and **Bolgatanga** (**Ghana)**	640 km	240 Million $	2017-2019
330 kV OMVG loop Niamey (**Niger**) - Birnin Kebbi (**Nigeria**) - Malanville (**Benin**) – Ouagadougou (**Burkina Faso**)	832 km	540 Million $	2017-2019
760 kV OMVG loop network through **Nigeria**	2700 km	2000 Million $	2019-2021
Median Backbone 330kV OMVG loop	713 km	238 Million $	2019-2021
330 kV OMVG double circuit loop Sakete (**Benin**) - Omotosho (**Nigeria**)	120 km	39 Million $	2021
225kV OMVG loop Salkadamna-Niamey (**Niger**)	190 km	72 Million $	2019-2021

4. ECOWAS-ACTION PLAN IMPLEMENTATION STRATEGIES AND STATUS

Regional Priority Projects planned for implementation **2011 – 2025:**

- **10 000 MW** to be installed of which **7 000 MW** will be hydro sources
- **16 000 km** of transmission lines

TOTAL INVESTMENT COST is **US$ 24 BILLION** with GENERATION COST of **US$ 18 BILLION** AND TRANSMISSION of **US$6BN**

Table 31: Status of implementation of ECOWAS transmission projects

Project	Status of implementation	Time of Commissioning
330 kV Riviera (Cote d'Ivoire) – Prestea (Ghana	Projects on-going	Expected commissioning 2015
330 kV Aboadze (Ghana) – Volta (Ghana)	Operational since 2010	Completed
330 kV Volta (Ghana) – Lome "C" (Togo) – Sakete (Benin)	Under-implementation	Completed
330 kV PHCN/TCN **(Nigeria)**	At level of preparation	Expected to be completed 2017
330 kV ABOADZE – PRESTEA – KUMASI –BOLGATANGA , Tumu – Han – Wa	At level of pre-investment	Expected to be completed 2015
Han (Ghana) – Bobo Dioulasso (Burkina Faso) –Sikasso (Mali)– Bamako (Mali)	Pre-investment	Expected to be completed 2015
225 kV Nzerekore (Guinea) - Fomi (Guinea) – Bamako (Mali)	Pre-investment	To be completed 2016
330 kV Birnin Kebbi (Nigeria) - Bemberke (Benin) – Niamey (Niger) Ouagadougou (Burkina Faso)	Pre-investment	To be completed 2017
147 MW WAPP Adjarala Hydropower Facility	Pre-investment	To be completed 2017
60 MW Felou Hydropower Project	At level of implementation	To be completed 2014

a. INTER-ZONAL TRANSMISSION HUB SUB-PROGRAM

(Burkina Faso, OMVS via Mali, Cote d'Ivoire via Mali, CLSG via Cote d'Ivoire).

The main transmission hub sub-programmes for the region include:

- 225 kV Bobo Dioulasso (Burkina Faso) – Ouagadougou (Burkina Faso);
- 225 kV Bolgatanga (Ghana) – Ouagadougou (Burkina Faso);
- 225 kV Cote d'Ivoire – Mali;
- 330 kV Aboadze (Ghana) – Prestea (Ghana) – Kumasi (Ghana) – Bolgatanga (Ghana) + Tumu (Ghana) – Han (Ghana) – Wa (Ghana);
- Han (Ghana) – Bobo Dioulasso (Burkina Faso) – Sikasso (Mali) – Bamako (Mali);
- 225 kV Fomi (Guinea) – Bamako (Mali) – Nzerekore (Guinea) – Linsan (Guinea)
- 147 MW WAPP Adjarala Hydro Power Facility

Both the generation and transmission projects identified under the ECOWAS Generation and Transmission Master Plan have been spread between phases 1, 2 and 3 according to:

The implementation of this master plan has been scheduled to ensure the load supply throughout the region. This will be implemented in line with following phases of development:

- **Phase 1: Commissioning in the period 2017-2019**
- **Phase 2: Commissioning between 2019 and 2021**
- **Phase 3: Commissioning at long-term (2021-2023)**

THE WEST AFRICA GAS PIPELINE (WAGP)

The West African Gas Pipeline project is an International Gas transmission system that will transport clean, reliable and cheap natural gas from Nigeria to customers in Benin, Togo and Ghana. The proposal for a natural Gas Pipeline across West Africa was made in 1982 by the ECOWAS Commission ECOWAS as a key regional economic goal. The World Bank undertook a study on this in 1992 which confirmed the viability of a Natural Gas Pipeline based on ample reserves of Nigerian Natural Gas and Regional Energy needs. The plan calls for Chevron and its partners to build a 620-mile offshore line capable of initially shipping 180 million cubic feet of Nigerian gas per day for sale to power plants and other major gas users in Ghana, Togo and Benin.

The main objectives of the gas pipeline master plan were three folds:

- To encourage Royal Dutch Shell and Chevron to tap into a vast resource that since the onset of oil production in the 1960s has been wasted in the associated gas burning-off process known as flaring.
- To provide a cheap source of energy in a region starved of electricity, by serving as International Gas Transmission System that will transport clean, reliable and cheap natural gas from Nigeria to customers in Benin, Togo and Ghana.

- Foster regional economic and political integration that would support economic growth, and in particular the development of the West Africa electricity market.

1.1 Agreement on project

In 2000, the four nations involved signed an Intergovernmental Agreement for a harmonized fiscal and regulatory framework for cross-border construction and operation of the gas pipeline. The four Nations and the West African Pipeline Company (WAPCo) signed International Project Agreement (IPA) for the development of the pipeline in 2003. Construction of the WAGP therefore began in 2005 and by 2008, the Pipeline construction had completed and gas introduced into pipeline.

1.2 The Project benefit

The project is the sub-region's solution to bringing energy for economic growth and environmental benefits to Ghana, Togo, Benin and Nigeria. To help in the energy access challenges in the sub-region, the WAGP aims to achieve the following benefits:

- provide a long-term supply of abundant, clean, relatively cheaper fuel from Nigeria to Ghana, Togo and Benin;
- transfer technical knowledge and skills to relevant public agencies, local consultants, contractors and their employees across the four countries
- Employ over 100 skilled people from the sub-region, on competitive selection basis. This number has been far greater during construction
- provide a new level of regional co-operation and economic integration to enhance regional stability under the auspices of ECOWAS
- serve as a catalyst for direct foreign investment in the project countries
- Provide Nigerian producers with benefit from additional revenues accruing from the sale of associated gas to WAPCo
- To provide each of the four countries with some direct tax benefits
- Provide the three gas recipient countries with some fuel gains
- Enhance the regional environment by substituting natural gas for less desirable fuels. It will also lead to reduction in gas flaring in Nigeria, reduction in greenhouse gas emissions, and serve as a springboard in the efforts against deforestation.

1.3 Status of Project implementation

The initial phase of the project implementation was completed in 2008 linking mainly an off-shore pipeline from Alagbado (Nigeria) to Takoradi (Ghana). Commissioning of the pipeline began in late Nov 2008. Gas introduced into the offshore pipeline on Dec 6, 2008 from Nigeria to Takoradi. Commissioning successfully completed on Dec 14, 2008. Construction of the Takoradi Regulating and Metering Station has been completed.

1.4 The future prospects

The project has the prospect of being extended from Takoradi in Ghana to Senegal. This will mainly be an off-shore development project and will augment the electricity and generation and distribution projects earmarked for the region in the Master Plan.