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ABBREVIATIONS

AfDB	African Development Bank
BEFS	Bioenergy and food security project
BKPS	Bo-Kenema Power Services
BHP	Bumbuna Hydro Power
BSL	Bank of Sierra Leone
CFL	Compact Fluorescent Lamp
CLSG	Cote' D'voire, Liberia, Sierra Leone, Guinea
COP 15	2009 United Nations Climate Change Conference
Disco	Distribution Company
ECOWAS	Economic Community of West African States
EE	Energy Efficiency
EFA	Environmental Foundation for Africa
EFO	Energy for Opportunity
EIB	European Investment Bank
EPP	Employment Promotion Programme
EPP	Emergency Power Project
EU	European Union
FDI	Foreign Direct Investments
FDP	Farmer Development Programme
FAO	Food and Agriculture Organization
FFLS	Farmer Field and Life School
GDP	Gross Domestic Product
Genco	Generation Company
GIZ	German Technical Cooperation
GoSL	Government of Sierra Leone
GTG	Global Trading Group
GTI	Government Technical Institute
GWh	GegaWatt hour
HOT	Heads of Terms
IEL	Income Electrix Limited
IIT	International Institute of Tropical Agriculture
IMF	International Monetary Fund
IPP	Independent Power Producers

JICA	Japanese International Corporation Agency
JRS	Joint Research Centre
KfW	Kreditanstalt für Wiederaufbau
Kv	Kilovolt
FY	Fiscal Year
LDC	Least Developed Country
LED	Light Emitting Diodes
LPG	Liquefied Petroleum Gas
MAFFS	Ministry of Agriculture Forestry and Food Security
MDG	Millennium Development Goals
MEWR	Ministry of Energy and Water Resources
MoFED	Ministry of Finance and Economic Development
MFO	Marine Fuel Oil
MFP	Multifunctional Platforms
MT	Metric Tonnes
MTA	Ministry of Transport and Aviation
MTI	Ministry of Trade and Industry
MW	MegaWatt
NAPA	National Adaptation Programme of Action
NGO	Non-Government Organization
NPA	National Power Authority
NRA	National Revenue Authority
O&M	Operation and Management
PRSP	Poverty Reduction Strategy Paper
PPP	Public-Private-Partnerships
PV	Photo Voltaic
RET's	Renewable Energy Technologies
SEFA	Sustainable Energy for All
SEEA-WA	Supporting Energy Efficiency for Access in West Africa
SFYDP	Safer Future Youth Development Project
SL	Sierra Leone
SLIEPA	Sierra Leone Investment and Export Promotion Agency
SME	Small and Medium Enterprises
SPU	Strategic Planning Unit
SSL	Statistic Sierra Leone
T&D	Transmission and Distribution
TOE	Tonnes of Oil Equivalent
UN	United Nation

UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nation Development Programmes
UNIDO	United Nations Industrial Development Organization
US	United States
USD	United States Dollar
WAPP	West Africa Power Pool
WB	World Bank

Figure 1: MAP OF SIERRA LEONE



Source: MEWR

BACKGROUND

Recognizing the importance and urgency of energy challenges, the United Nations General Assembly last year declared 2012 the International Year of Sustainable Energy for All (SEFA). SEFA seeks to achieve three key objectives by 2030: (i) encourage universal access to modern energy services, (ii) double the global rate of improvement in energy efficiency, and (iii) double the share of renewable energy in the global energy mix. Sierra Leone is being considered to become one of the pilot countries of the SEFA initiative.

In Sierra Leone, UNDP and UNIDO are co-leading the support to the implementation of the SEFA initiative. As part of the process for the selection of potential first-movers, a mission was received in early June 2012 from the EU and UNDP to assess Government readiness and commitment to the initiative.

The provision of energy is vital for the realization of sustainable economic growth and human development. However, figures on energy consumption, production and challenges to access and production are rather outdated in Sierra Leone and do not reflect the present state of energy in the country. A first step to getting a good updated overview of the sector is the development of a comprehensive energy profile that describes energy consumption and production, trends and challenges in meeting the energy needs of the country. Such a profile would form the basis for Government action and investment in this sector.

Energy access is a high priority in the government's Agenda for Change and the SEFA initiative is, therefore, timely for Sierra Leone. It is important to have a document reflecting the state of play in the energy sector. An energy profile would serve to build readiness for the assessment mission, next steps recommended by the mission and a road map for strategic energy development in Sierra Leone.

This report provides an overview of the current national energy profile of Sierra Leone using the SEFA template. The data and information were collected through reports, meetings, and interviews with authorities and relevant actors. Information collected from these sources has been complemented by desk research.

OBJECTIVE

The purpose of the Rapid Assessment and Gap Analysis is to provide:

- A brief look at the energy situation in Sierra Leone within the context of its economic and social development and poverty eradication
- A good review of where Sierra Leone currently stands in terms of the three SEFA goals
- A good estimate of the main challenges and opportunities vis-à-vis the three SEFA goals and an assessment of where the major investments, policies and enabling environments will be required, and
- A sound basis and background for an Action Plan that may follow as part of the SEFA activities in Sierra Leone

EXECUTIVE SUMMARY

Sierra Leone is situated in Western Africa with a total land area of approximately 72,325 sq. km. According to Statistics Sierra Leone (2012), the population is estimated at 6.0 million in 2011 with a growth rate of 3.3%. The capital city of Freetown is located in the western area of the country and is home to approximately 1.25 million people (~21% of the total population). Sierra Leone has a tropical climate with hot and humid weather in the rainy season, which usually spans from June to November and a dry season, which typically spans from December to May. The country has an ambient temperature range of 27°C - 35°C and relative humidity varying from an average of 80% in the rainy season to about 50% in the dry season. The country has substantial deposits of mineral resources such as diamonds, rutile, titanium, bauxite, iron ore, gold, and chromium.

Sierra Leone is considered by the UN classification as a Least Developed Country (LDC) with significant inequality in income distribution among its people. While it has substantial mineral, agricultural, and fishery resources, its economic and social infrastructure are not well developed, which hampers its economic development.

Energy consumption in Sierra Leone is dominated by biomass, which accounts for over 80% of energy used. The largest source of biomass energy is wood fuel followed by charcoal. Imported Petroleum Products are the next largest source of power at approximately 13%. Grid-generated electricity accounts for the remainder of the power supplied to the country's citizens. Wood fuel is the traditional form of energy and is used almost exclusively by households for cooking and craft activities. Petroleum, on the other hand, is the most important source of energy for the modern productive Energy Sector (including transportation and private electricity generation). Recently, foreign exchange difficulties have restrained Petroleum imports, which are currently subsidized by Government.

Currently, the Electricity sub-sector in Sierra Leone faces challenges with less than 10% access. Efficiency and access are constrained by high technical losses on the T&D Network, which are further compounded by low voltage quality due to overburdening of infrastructure by illicit users. The stock of energy efficient appliances and equipment also remains low. Further, the development and use of Renewable Energy from Hydro, Solar, Biomass and other facilities has been a slow process.

Nevertheless, Sierra Leone has great potential in energy resources and opportunities for the productive use of energy and development of energy facilities. Some of these opportunities include: the presence of strong political will, a stable political and security situation, a tropical climate conducive for solar, high levels of rainfall for hydro, the development of the West Africa Power Pool (WAPP), a large landscape of green vegetation for biomass, good working relationships between government and development partners and a good environment of doing business. Sierra Leone requires huge investment support in the energy sector to meet the SEFA goals by 2030. Successful execution relative to the goals would mean increasing access to electricity to about 100%, increasing energy efficiency to a level of 12-15% and increasing renewable energy level to about 7,000 ktoe. Importantly, these stated objectives of the Government of Sierra Leone (GoSL) align completely with the goals of the Sustainable Energy for All (SEFA) Initiative.

The level of energy consumption in the country has grown substantially between 2006 and 2011 from 1,349 ktoe to 1,465 ktoe respectively. Nevertheless, there remains a huge gap of suppressed demand for energy especially in the electricity sub-sector. Economic expansion in mining, agriculture and industry is also accelerating demand.

To reach the SEFA goals and improve the country's energy sector by 2030, it is estimated that Sierra Leone will require investment and/or financial support of approximately \$7.8 billion over 18 years.

Currently, there are four ministries with an interest in implementing and supporting Government Energy Programmes including the Ministry of Energy and Water Resources (primary stakeholder), Ministry of Agriculture Forestry and Food Security, Ministry of Lands and Environment and Ministry of Trade and Industry. To ensure optimal coordination, the Ministry of Energy and Water Resources (with oversight responsibility) will lead the effort to ensure that the SEFA initiatives are implemented in Sierra Leone.

Improving the country's energy sector is one of the Government's foremost objectives. This critical priority was articulated in the Government's Agenda for Change, which was unveiled in 2007. Beyond political support, the Government intends to devote financial resources to improving the sector because of the clear positive impacts on social and economic development. The Government is committed to working with the private sector, International Energy Development Programmes and the donor community to achieve these essential improvements.

As the Government effects the progression for the Agenda for Change to the transformative agenda for prosperity, the well-timed SEFA initiative provides a strong opportunity to accelerate the national development agenda. As such, the Government embraces the goals of the SEFA initiative and will do everything in its power to achieve critical targets by 2030. Of course, the ability of the Government to meet these targets will depend on funding as well as the growth of population, GDP, and access to essential technologies.

Section I: Introduction

1.1 OVERVIEW OF SIERRA LEONE

1.1.1 BRIEF INTRODUCTION

Sierra Leone is situated in Western Africa with a total land area of approximately 72,325 sq. km. According to Statistics Sierra Leone (2012), the population is estimated at 6.0 million in 2011 with a growth rate of 3.3%. The capital city of Freetown is located in the western area of the country and is home to approximately 1.25 million people (~21% of the total population). Sierra Leone has a tropical climate with hot and humid weather in the rainy season, which usually spans from June to November and a dry season, which typically spans from December to May. The country has an ambient temperature range of 27°C - 35°C and relative humidity varying from an average of 80% in the rainy season to about 50% in the dry season. The country has substantial deposits of mineral resources such as diamonds, rutile, titanium, bauxite, iron ore, gold, and chromium.

According to Statistics Sierra Leone (2004), the average population density is about 75 inhabitants per square kilometres. Life expectancy at birth is 41.1 years and the fertility rate (i.e. births per woman) is 6.5. The infant mortality rate is 165.4 out of 1,000 live births.

Sierra Leone is considered by the UN classification as a Least Developed Country (LDC) with significant inequality in income distribution among its people. While it has substantial mineral, agricultural, and fishery resources, its economic and social infrastructure are not well developed, which hampers its economic development.

The Gross Domestic Product (GDP) per capita of Sierra Leone was estimated to be around 482 US\$ in 2011. The country has achieved relative stability in the post-conflict years and economic prospects appear to be improving. Still, the country faces a number of development challenges as it recovers from the consequences of the armed conflict that devastated its economy and infrastructure. A large fraction of government revenues still comes from development aid.

The economy continued the strong recovery in 2011 with expansion in the agricultural and services sectors supported by increased availability of electricity and the scaling up of infrastructure investments. The economy is estimated to have grown by 6 percent in 2011 from 5 percent in 2010. Domestic revenue increased during the past year, mainly as a result of tax collection efforts and one-off payments of signature bonuses from petroleum exploration activities. Inflationary pressures were high during the first half of the year on account of the continued increase in the international prices of food and fuel and the consequent pass through into domestic prices. However, inflationary pressures eased in the second half of the year as international prices of commodities stabilized as monetary and fiscal policies were tightened.

A number of Petroleum Exploration offshore oil discoveries were announced in 2009 and 2010. The Government and Parliament have developed the Petroleum Policy for Sierra Leone in July, 2010 and the Petroleum (Exploration and Production) Act 2011. The development of these reserves, which could be significant, is drawing serious attention from the Government of Sierra Leone.

Furthermore, Sierra Leone has a significant infrastructure deficit in many sectors such as electricity, roads, water supply, ports and communications. In some sectors, such as telecommunications and port operations there has been an increase in private investment.

More recently, some private investment has also targeted the energy sector (e.g. power plants and ethanol production).

1.1.2 ENERGY

A key priority of government in 2009 was to strengthen the energy sector with the aim of stimulating economic activities. To achieve this goal, the Government switched the budget of the Ministry of Energy and Water Resources from recurrent to domestic development expenditures in FY2009. Total revised budget for non-salary/non-interest recurrent expenditures allocated to the Ministry of Energy and Water Resources amounted to Le72.6 billion in FY2009.

Government flexed the budget of the Ministry of Energy and Water Resources, specifically for the Emergency Power Project (EPP), when it was noted that the completion of the Bumbuna Hydro Electric Project would be delayed from a couple of months in FY2009. As a result, the budget execution rate of the Ministry of Energy and Water Resources was close to the revised target with a deviation of only 5.6% below the revised budget in 2009. The total non-salary/non-interest recurrent expenditures in the Ministry of Energy and Water Resources amounted to Le68.5 billion in FY2009 compared to the revised budget of Le72.6 billion. The EPP was to be discontinued around Q3, 2009 after the completion of the Bumbuna Hydro-electric project in FY2009. But government decided to extend the EPP programme to the end of FY2009 as a backstopping measure when it became apparent that the full commissioning of the Bumbuna Hydro Electric Project would be delayed.

Electricity grid generation increased by 3.1 percent to 175.7 GWh in 2011 compared to 170.5 GWh in 2010. Industrial consumption of electricity increased to 30.6 GWh from 24.9 GWh in the previous year, an increase of about 23.1 percent. Line losses remained high estimated at about 40 percent of units generated.

The European Investment Bank (EIB) has disclosed plans to collaborate with other donor partners namely: the World Bank, African Development Bank (AfDB) and Kreditanstalt für Wiederaufbau (KfW) in the area of Sierra Leone's energy sector, through the West Africa Power Pool (WAPP)

Project. The EIB also intends to fund the feasibility studies of the electricity interconnection under the WAPP, which will usher in a strategic power market for the region when completed.

1.1.3 AGRICULTURE

Agriculture and fishing are vital components of the Sierra Leonean economy. Agriculture is still very traditional and conducted in small-scale farms. The most important crops are rice, cassava, sweet potato and sugar cane. Other food crops grown in the country include maize, sorghum, fundi (cereal), and groundnuts. Cocoa and coffee, oil palm and kola nuts are grown largely for exports.¹

The fisheries sector has industrial and artisanal components. The industrial component is mainly devoted to exports, employs substantially less workers than the artisanal one, but produces a higher tonnage. The artisanal component, while engaging more workers, has a smaller output destined mainly for domestic consumption.

Data on coffee output were available for only four months of 2011. Production of cocoa has increased by 16.6 percent to 18,784 metric tons from 16,112 metric tons for 2010.

Anecdotal evidence indicates an increase in domestic production of basic food crops including rice, cassava and sweet potato mainly as result of the increase in the supply of essential inputs such as tractors, seeds, fertilizers, power tillers, combined harvesters, to farmers by Government and Development Partners through the Small Holder Commercialisation Programmes and the Rural Private Sector Development Project.

1.1.4 MINING

The mining sector is also in the process of recovery. The diamond industry is being reorganized, and Sierra Leone has signed up to the Kimberley process, which is a joint initiative involving governments, the international diamond industry and NGOs to stem the flow of conflict diamonds. There is still smuggling, but government revenue from diamonds has increased in the recent past. Bauxite, Rutile and Iron Ore Mining have also restarted operations.

Output of minerals remained subdued during the year 2011. With the exception of bauxite, the output of all other minerals declined during 2011. Production of bauxite increased by 35.2 percent while output of diamond fell by 19.6 percent, rutile by a marginal 0.3 percent, ilmenite by 12.57 percent and gold by 35.4 percent. Iron ore production began in the last quarter of the year with an output of 137,910 metric tons by African Minerals Limited. London Mining Limited is in the process of making its first shipment.

¹ National Investment Brief. SIERRA LEONE. High-Level Conference on: Water for Agriculture and Energy in Africa: the Challenges of Climate Change. Sirte, Libyan Arab Jamahiriya, 15-17. December 2008.

1.1.5 MANUFACTURE

The manufacturing sector was buoyant in 2011. With the exception of soft drinks and paint, the output of all manufactured goods increased during the year. The output of beer and stout grew by 17.3 percent, maltina by 59 percent, cement by 3.3 percent, confectionary by 17.7 percent, acetylene by 8.5 percent, oxygen by 6.5 percent, common soap by 19.2 percent and flour by 66.2 percent. The production of soft drinks and paint declined by 4.1 percent and 12.6 percent respectively. The relatively improved performance of the manufacturing sector reflected the increased availability of electricity and increased domestic demand. Industrial electricity consumption rose significantly during the year.

1.1.6 CONSTRUCTION

Data on building permits issued in 2011 are not yet available. Another proxy for construction data may be cement production. This proxy suggests growth in the construction sector, with production of cement increasing by more than 3 percent over 2010.

1.1.7 TELECOMMUNICATION

Among six licensed GSM operators, three are in active operation (Africell, Airtel and Comium). The telecom sector continued to expand in 2011. Information provided by National Telecommunications Commission shows that as of July 2011, the total number of mobile phone subscriptions stood at 3,039,522 compared to 1,752,607 in 2010. The overall tele-density increased by 73 percent. Given that some individuals hold multiple handsets, the real increase in tele-density is estimated at 35 -36 percent. There were 18 major licensed National Public Internet Service Providers and 64 licensed VSAT operators. The number of private VSAT authorizations with access to Broadband Internet Service is estimated to be more than 5,000.

1.1.8 BANKING

The number of commercial banks operating in the country remained unchanged at 13 in 2011. The number of bank branches, however, increased from 80 at end 2010 to 87 in 2011. Deposit taking and lending activities by commercial banks have expanded rapidly. Total deposits held in commercial banks increased by 24 percent in 2011. Of the total deposits, foreign currency deposits

have increased by 29.3 percent. Credit to the private sector by commercial banks increased by 22 percent to Le 1.07 trillion at end 2011 from Le 894.3 billion at end 2010. Credit to the agricultural sector grew by 29 percent, mining by 79 percent, construction by 44 and energy, gas and water by over 237 percent relative to end 2010.

1.1.9 TRANSPORT

The number of newly-registered vehicles has increased by 49 percent to 26,498 from 17,795 in 2011. Newly-registered buses above 18 passengers increased by 96 percent and lorries with six tyres increased by 76.7 percent while lorries with more than 6 tyres increased by 124.6 percent. Newly-registered tractors and trailers increased by almost 200 percent reflecting increased economic activities in the agriculture, construction and mining sectors.

1.1.10 TOURISM

The total number of visitors to Sierra Leone has increased by 35.8 percent to 52,442 in 2011 from 38,615 in 2010. The increase in tourist visits was due the improved political and economic climate as well as the efforts by the tourist board to market the country a safe place for visitors.

1.1.11 SOCIO-ECONOMIC DATA

The key socio-economic indicators of Sierra Leone for the periods (2007 – 2011) and for the 80's & 90's respectively are shown in Tables 1a and 1b.

Table 1a Key Socio-Economic Indicators

	2007	2008	2009	2010	2011
Population (millions)	5.35	5.48	5.62	5.8	6.0
	Act	Act	Act	Act	Prel.
	Annual percentage change				
Income and Expenditure					
Real GDP (at Constant Prices)	8.0	5.4	3.2	5.3	6.0
Excluding Iron Ore					6.0
GDP Deflator	6.6	9.2	8.6	17.0	17.9
Nominal GDP/1	17.9	17.4	10.5	12.5	12.1
Consumer Prices (end of period)	13.8	12.2	10.8	18.4	16.9
Consumer Prices (annual average)	11.7	14.8	9.2	17.8	18.5
Memorandum items:					
Gross international reserves (US\$ millions)	215.5	209.5	333.5	338.5	343.5
(in months of imports) 9/	4.3	4.4	4.1	2.1	2.4
Excluding iron Ore, months of Imports			4.1	5.0	3.3
GDP (billions of Leones)	6,345.0	7,304.0	8,183.0	10,084.0	12,602.0
Excluding Iron Ore/4			8,183.0	10,084.0	12,602.0
GDP (millions of U.S. dollars)	2,126.0	2,447.0	2,400.0	2,529.0	2,889.0
Per Capita GDP (US\$)	357.0	388.0	421.0	432.0	482.0

Source: Ministry of Finance and Economic Development, Bank of Sierra Leone and Statistics Sierra Leone. May, 2012

Key Historic Socio-Economic Indicators Table 1b

Indicator	1980-1989	1990-1999	2011
	average	average	
Population (millions)	3,6	4	6,0
GDP at market prices (billion of dollars)	1,3	1,1	2.88
GDP per capita (dollars)	364	279,4	482
Real GDP growth (%)	2,8	-7,3	6,5

Source: Ministry of Finance and Economic Development, Bank of Sierra Leone and Statistics Sierra Leone. May, 2012

Based on the data in table 2 (below), the GDP % contribution by sector shows that Agriculture, Forestry and Fishing are the highest contributors (ranged 55%-58%) whilst the Industry, Mining, Manufacturing and Energy are the lowest contributors (ranged 7%-10%).

Table 2: GDP % SHARE BY SECTOR

GDP by sector %	1980-1989 average	1990-1999 average	2007	2008	2009	2010	2011
Agriculture, Forestry and Fishing	42.5	40.9	51	56	58	56	57
Industry, Mining, Energy, and Manufacturing	10.6	11	10.6	8	7	8	8
Services	46.9	48.1	38.4	36	35	36	35

Source: Ministry of Finance and Economic Development, Bank of Sierra Leone and Statistics Sierra Leone. May, 2012

The Government budget and expenditure on the energy sector increased during the period from 2009 through 2011 due to the high priority placed by His Excellency on improving the energy situation to create a positive impact on the socio-economic life of the people. The budget and expenditure figures for 2009, 2010 and 2011 are shown in Tables 3, 4, 5, 6 and 7. The data are in millions of Leones.

Table 3: Budget and Expenditure for 2009.

	98038.52
<u>Recurrent Budget</u>	
Ministry of Energy and Power	68432.8
Office of the Perm. Sec.	65148.7
of which: Fuel for Emergency Power Programme	59496.9
<u>Development Budget</u>	
ELECTRICITY DIVISION	29605.72
Bumbuna Hydro Electric Project	19116.98
Bumbuna Hydro Electric Project Implementation Unit (PIU)	4767.976
Power Generation and Distribution Project (Western Area) - Low and High Voltages	4880.762
Rehabilitation of Bo/Kenema Power Services	840
Rural Electrification Project	0
Support to the Energy Sector	0
Bumbuna Transmission Lines Project	0

Source: Ministry of Finance & Economic Development Budget Unit (2012)

Table 4: Budget and Expenditure for 2010.

	162,387
<u>Recurrent Budget</u>	
Ministry of Energy and Power	44,967
Office of the Permanent Secretary	40,143
<i>of which: Fuel for Emergency Power Programme</i>	38,468
<u>Development Budget</u>	
ELECTRICITY DIVISION	117,420
Bumbuna Hydro Electric Project	22,870
Bumbuna Hydro Electric Project Implementation Unit (PIU)	832
Bumbuna Hydro Electric Project Environmental and Social Management	0
Power Generation and Distribution Project (Western Area) - Low and High Voltages	11,131
Western Area Power Generation Project	0
Rehabilitation of Bo/Kenema Power Services	3,381
Rural Electrification Project	77,245
Support to the Energy Sector	0
Bumbuna Transmission Lines Project	1,961
Extension of Bumbuna Hydro Electricity and Thermal Energy to Selected Towns	0
Lungi Thermal Electricity Project	0

Source: Ministry of Finance & Economic Development Budget Unit (2012)

Table 5: Summary of Domestic Development Expenditures for FY 2010

Particulars	FY2010		
	Budget	Actual	Variance
	/ Le'm	/Le'm	/Le 'm
Infrastructure:	150,024	261,848	-111,824
Energy	49,591	117,420	-75,646
Roads	83,258	139,294	-56,036
Water Supply	17,175	5,134	12,041
Agriculture	8,742	4,088	3,736
Health	6,856	12,517	-5,661
Local Government Development Grants	1,484	13,613	-12,129
Others	57,074	63,042	-5,968
Total	224,180	355,108	-130,928

Source: Ministry of Finance & Economic Development Budget Unit (2012)

Exchange Rates in 2010 @ year average: Le3,978 = 1US dollar.

Table 6: Summary of Domestic Development Expenditures for FY 2011

Total	89,214
<u>Recurrent Budget</u>	
<i>Ministry of Energy and Water Resources</i>	14,199
<i>Office of the Perm. Sec.</i>	14,199
<i>of which: Fuel for Emergency Power Programme</i>	0
<u>Development Budget</u>	
ELECTRICITY DIVISION	75,015
<i>Bumbuna Hydro Electric Project</i>	0
<i>Bumbuna Project Implementation Unit (PIU)</i>	772
<i>Bumbuna Hydro Electric Project Environmental and Social Management</i>	0
<i>Western Area Power Generation Project</i>	0
<i>Extension of BHP to Bumbuna Town and Surrounding Villages</i>	1,651
<i>Electrification of District and Provincial Headquarter Towns:</i>	72,508
<i>o/w: Thermal Plants</i>	28,915
<i>o/w: Rehabilitation of Bo/Kenema Power Services</i>	3,308
<i>Transmission and Distribution Materials</i>	36,127
<i>Prepaid Meters</i>	4,478
<i>Bumbuna Transmission Lines Project</i>	0
<i>Reinforcement of Medium and Low Voltage Distribution Network (Western Area)</i>	84
<i>Power and Water Project (Energy Component)</i>	0

Source: Ministry of Finance & Economic Development Budget Unit (2012)

Table 7: Transfers and Subsidies in millions of Leones for 2011.

Transfers and subsidies				
Particulars	FY2011 Rev. Budget	FY2011 Actual	%	Variance
Total Transfers and subsidies	263,164	232,195	88%	30,969
Transfers to Local Councils	81,733	76,056	93%	5,677
Grants to Educational Institutions	48,523	48,413	100%	109
Transfer to Road Fund	37,465	12,282	33%	25,183
Fuel Subsidies	95,444	95,444	100%	0

Source: Ministry of Finance & Economic Development Budget Unit (2012)

1.2 ENERGY SITUATION IN SIERRA LEONE

1.2.1 BRIEF INTRODUCTION

Sierra Leone is extensively endowed with energy potential particularly biomass energy, which is estimated at 1,262,000 toe for the year 2011 and has a capacity of generating 14,674 GWh (based on population baseline of 3.52 million, growth rate of 3.3% in 2011, per capita consumption of 0.42m³ /cap/ annum and 0.11m³ / cap/ annum for fire wood and charcoal respectively) Conteh (1997) and Statistic Sierra Leone Publication (1995) as cooking energy, hydroelectricity sources and solar energy. Most of the energy production and use in Sierra Leone (SL) is concentrated in the household sub-sector, where biomass, in the form of unsustainable fuel wood and charcoal is used for cooking and kerosene is used for lighting. Only about 9% of the population has access to electricity from the national power grid. The fact that the primary energy supply of SL in 2011 consisted of over 85% renewable including Biomass and Hydro and 15% oil further adds pressure on the fragile forest resources.

The country possesses vast potential in renewable energy in the form of biomass from agricultural wastes, hydro and solar power, which remain virtually untapped. Oil exploration activities are being undertaken. Petroleum Policy and Laws are in place to ensure accountability and transparency of its administration.

Energy statistics are difficult to obtain in Sierra Leone, especially for renewable energy. Although the conventional thermal energy production and consumption patterns have been reported, no consolidated set of statistics exists for the total Energy situation of Sierra Leone. The figures presented in this document should be regarded as indicative of the orders of magnitude rather than as precise consumption figures.

The energy supply consists of electricity, petroleum products and renewable energy, including hydropower. In these sub-sectors, the focus is on increasing the supply of modern energy supplies for Sierra Leone.

The energy demand comprises of household, agriculture and fisheries, commercial and services, industrial, mining and transport.

1.2.2 ENERGY CONSUMPTION IN SIERRA LEONE

Table 8 (below) represents the Energy that Households, Industry, Service, Agriculture and Forestry, Fishing, and the Transport Sector used from Electricity, Fuel and Renewable (such as Thermal, Oil, Hydro, Wood fuel).

Table 8: TREND OF ENERGY CONSUMPTION IN SIERRA LEONE (2006 – 2011)

Year	Biomass Consumption '000'toe	Petroleum Products Consumption '000'toe	Electricity (Grid Connected) Consumption '000'toe	Final Energy Consumption '000'toe
2006	1,154	195.7	3.4	1,353.1
2007	1,175	166	3.21	1,344.21
2008	1,197	192.4	12.79	1,402.19
2009	1,218	164.5	12.28	1,394.78
2010	1,241	199.3	16.21	1,456.51
2011	1,262	187.8	16.14	1,464.94

Source: Ministry of Agriculture and Food Security (2012), PU (2012), MEWR and NPA-BKPS.

1.2.3 STRUCTURE OF THE ENERGY CONSUMPTION PATTERN IN SIERRA LEONE

The structure of the energy consumption in Sierra Leone by sectors and energy carriers as reported by the national energy strategic plan is presented in the table 9 (below). It should be noticed that figures for the year 2008 and 2011 have been extrapolated from original figures given in a study by the World Bank for the year 1986.

As can be seen, fuelwood still represents the main energy carrier in the country. The bulk of fuel wood consumption takes place in the household sector, mainly for cooking in rural areas. Charcoal is also consumed in the residential sector, mainly for cooking purposes in urban areas. Still, there is some consumption of fuelwood and charcoal in the industrial sector.

Table 9: STRUCTURE OF ENERGY CONSUMPTION PATTERN IN 2011

Sector	Biomass		Petroleum Products	Electricity (Grid Connected) (Thermal, Hydro etc.)	Total %
	Fuelwood	Charcoal			
Agriculture, Forestry, Fishing	1%	-	5%	2%	2%
Mining	-	-	9%	1%	2.5%
Industry/Commercial	3%	10%	12%	60%	21%
Transport	-	-	49%	-	12%
Household/Residents	96%	90%	25%	37%	62.5%
Total	100%	100%	100%	100%	100%

Source: Ministry of Agriculture and Food Security (2012), PMU (2012), MEWR and NPA-BKPS (2012).

1.2.4 BIOMASS CONSUMPTION IN SIERRA LEONE

Biomass is the major source of energy used in Sierra Leone for cooking and lighting in many households. As shown in table 10, this energy source carries the highest volume of consumption in the whole energy mix, representing over 80% of total energy consumed in Sierra Leone.

Table 10: TREND OF BIOMASS CONSUMPTION IN SIERRA LEONE (2006 – 2011) '000'toe

BIOMASS	2006	2007	2008	2009	2010	2011
FUEL WOOD	1,111	1,126	1,136	1,144	1,156	1,161
CHARCOAL	43	49	61	74	85	101
TOTAL '000'toe	1,154	1,175	1,197	1,218	1,241	1,262

Source: Ministry of Agriculture, Forestry and Food Security (2012)

1.2.5 PETROLEUM PRODUCTS CONSUMPTION AND SUPPLY IN SIERRA LEONE

Petroleum products importation has been done through refined products like Gasoline or Petrol, Diesel, Marine Fuel Oil, Kerosene and Jet A-1 as shown in table 11 due to the absence of a domestic refinery. The Petroleum Products are consumed mainly in the transport and residential sector. Sierra Leone currently imports all its petroleum products. The only refinery in the country is no longer operational. Petroleum products are mainly used for electricity power generation and transport.

As shown in Table 11, Petroleum Product importation volume per annum increased by more than 100% between 2000 and 2011. Petroleum products consumption averaged 184,290toe per annum as shown in Table 12.

Table 11: Petroleum Products Imported in Sierra Leone (2000 – 2011) in Metric Tons (MT)

Year	Petrol	Diesel	Kerosene/Jet A-1	Marine Fuel Oil	Total
2000	29,874	39,561	39,981	15,607	125,023
2001	28,370	31,540	35,701	26,824	122,435
2002	36,524	49,462	54,786	26,433	167,205
2003	47,498	59,205	56,009	26,988	189,700
2004	54,880	68,663	52,612	34,432	210,587
2005	54,105	177,931	33,087	16,347	283,891
2006	59,317	160,902	28,089	18,825	270,657
2007	49,792	128,597	21,631	8,799	208,820
2008	60,424	156,136	13,933	18,324	248,818
2009	51,368	99,151	13,320	6,443	170,283
2010	78,297	99,745	12,093	23,351	217,695
2011	86,620	144,624	14,111	19,100	266,248

Source: Petroleum Unit (PU) Sierra Leone, 2012.

Table 12: TREND OF PETROLEUM PRODUCTS CONSUMPTION IN SIERRA LEONE (2006 – 2011)
 '000'toe

PRODUCTS	2006	2007	2008	2009	2010	2011
GASOLINE	68	45.6	70.3	71.6	90.7	93.2
LPG	1	1	1	1	1	1
DIESEL	90.4	94.2	101.7	76.2	92.2	77.1
FUEL OIL	5.3	2.4	2.4	6.1	9.6	13
KEROSENE/JET	31	22.8	17	9.6	5.8	3.5
Total '000'toe	195.7	166	192.4	164.5	199.3	187.8

Source: PU (2012)

1.2.6 ELECTRICITY SITUATION IN SIERRA LEONE

The electricity sector in Sierra Leone is severely challenged across generation, transmission and distribution. It is estimated that less than 10% of the population has access to electricity. Generation capacity is insufficient and transmission and distribution networks are largely inadequate and aging. A large part of the electricity network suffered damage during the war. Activities in recent years have concentrated on bringing the existing network back to operation. The current electricity system covers mainly the western region of the country. The bulk of electricity consumption takes place in Freetown, the capital city.

The Western area, where Freetown is located, is supplied by the National Power Authority (NPA) and Bumbuna Hydro Power. Bo and Kenema, two other major cities in the southeast of Sierra Leone, are served by the Bo-Kenema Power Services (BKPS). The generation park of BKPS consists of a thermal power plant with an installed capacity of 5 MW located in the city of Bo and a hydro power station with 6 MW situated in the area of Dodo. Originally, there were provincial systems consisted of 12 isolated systems located in headquarter towns. But, most of these systems were destroyed during the war, with the exception of the Bo-Kenema Power Station (BKPS).

Frequent blackouts are experienced in the Freetown peninsula and other served areas. In some areas, electricity supply is available to customers only for a few hours every week. There has not been any expansion of the electricity networks to other regions in the country for the past years. Most areas in the interior of the country are wholly or largely without access to electricity.

Transmission and distribution networks are more than 50 years old and are poorly maintained. Therefore, these networks are currently not capable of transmitting more than 36 MW of power. This poses a serious bottleneck for additional generation capacity being added to the grid or in planning.

Generation capacity is still too small as compared to potential demand. The insufficient generation capacity in combination with the poor capacities of the transmission network has led many industries as well as commercial and residential customers to purchase imported diesel generators. Small generators cost on average US\$300, but low load level consumers can buy cheaper brands for about US\$100.² However, these small generators are expensive to run, because fuel costs are high. Several private sector investors are forced to self-generate in order to meet their own power requirements (e.g. cement manufactures, mining companies and mobile phone operators). The capacities installed by these private investors are substantial (ranging from 175 to 250MW) when compared to the total installed generation capacity in the country. The need to self-generate makes it more expensive for these companies to do business in the country.

More recently, some additional generation capacity has been added. The hydro plant Bumbuna I (50 MW installed capacity, 18 MW firm generation capacity in the dry season) entered into operation late 2009. The GoSL through the MEWR has signed a Heads of Terms (HOT) with Joule Africa to develop Bumbuna II and the extension of Bumbuna I and they have done a pre-feasibility study which reveals that the project could generate power up to 389MW with a firm capacity of 112MW in the dry season. Joule Africa is currently conducting a bankable feasibility.

The government is currently pursuing options to add more generation capacity. Two major projects for power generation are currently being developed. These power plants will run on a combination of natural gas and heavy fuel oil. These projects are expected to partially address grid reinforcements, in order to reduce the grid bottlenecks that would prevent their electricity from reaching customers.

Electricity transmission is made at voltage levels of 33 kV/11 kV. Distribution is made at 450 Volts (three-phase) and 250 Volts (single-phase). The overall electricity system losses amount to about 45%, including both technical and commercial losses. The National Power Authority (NPA) has undertaken efforts to reduce electricity theft. One of the difficulties in monitoring consumption and reducing theft is the fact that meters are not standard and there is not a sufficient number of them in the country. Although pre-paid meters have been instrumental in achieving some relief, they are not theft-proof.

Electricity is consumed in the mining, industrial and households sector, but consumption is still well below potential demand due to restrictions in generation as well as transmission and

² Country Chapter: Sierra Leone. Renewable Energy in West Africa. German Technical Cooperation (GIZ), 2008.

distribution capacities. There is growing demand for electricity and petroleum products in the agriculture sector for irrigation and machinery.

Grid-connected electricity consumption in Sierra Leone is shown in Table 13 (below). This table shows that most of the electricity generated came from the Bumbuna Hydropower. Table 14 shows the current status of installed generating capacity in Sierra Leone as of May, 2012.

Table 13: TREND OF GRID GENERATED ELECTRICITY CONSUMPTION IN SIERRA LEONE (2006 – 2011) ‘000’toe

POWER STATION	2006	2007	2008	2009	2010	2011
KINGTOM	2.75	2.6	10.2	6.6	3.5	1.14
BLACKHALL ROAD	Nil	Nil	1.8	1.4	Nil	0.81
BUMBUNA	Nil	Nil	Nil	3.5	11.8	13.5
BKPS	0.65	0.61	0.79	0.78	0.91	0.69
Total ‘000’toe	3.4	3.21	12.79	12.28	16.21	16.14

Source: MEWR, NPA, BKPS and BHP (2012)

Table 14: INSTALLED POWER CAPACITY IN SIERRA LEONE AS OF MAY, 2012

Type of power plant	Installed Capacity in MW	Number of Plants	State Owned, Private, Mixed	Grid Connected or Decentralized Plant
Thermal Oil Plant	37	7	State Owned	Grid Connected
Large Hydropower plants (>10MW)	50	2	State Owned	Grid Connected
Small Hydropower Plants (< 10MW)	6.75	4	State Owned	Grid Connected
Auto-Generators (135MW) plus two years import (39MW)	135+39 = 174	33,000	Private	Isolated
Mining Company Gen.	88.5	Unknown	Private	Isolated
Photovoltaic	0.025	Unknown	Mixed	Isolated
TOTAL MW	356.3			

Source: MEWR, NPA, NRA and SPU (2012)

Section 2: Current situation with regard to SEFA goals

2.1 ENERGY ACCESS vis-à-vis SEFA GOALS

2.1.1 BRIEF INTRODUCTION

Access to energy services is a major concern in Sierra Leone, where a majority of the population does not have access to modern energy carriers. Access to Electricity in Sierra Leone was 3%, 4%, 7.4% and 9% in 1999, 2005, 2008 and 2011 respectively. Traditional uses of biomass, mainly in the form of charcoal and firewood still dominate the energy mix with substantial impacts on economic activities, livelihood, health and environment. Moreover, lighting in rural areas is mainly based on kerosene lamps as discussed above. Less than 10% of households have access to electricity in the country. Thus, there is an urgent need to improve access to energy, particularly for low-income segments of the population. Activities in the fields of energy efficiency and renewable energy should be, whenever possible, framed in the context of access to clean, modern and affordable energy carriers in rural and urban areas and as a contribution to poverty alleviation and income generation.

In Sierra Leone, the Ministry of Energy & Water Resource has the primary responsibility concerning energy access programs. Based on the National Energy Policy, a National Electrification Scheme is to be set up by the Ministry to provide 100% access to electricity by 2030. The implementation of the government's policy of universal access by 2030 is the most important actions in this regard. To accomplish this, all Regional and District capitals will need to be connected to the national grid. Additionally, ongoing effort should be made to provide electricity to rural areas through a variety of sources and mechanisms.

As part of the implementation of the ECOWAS white paper on energy access, the need to integrate energy access into national and regional poverty reduction strategies has been recognised. As stated above, the Poverty Reduction Strategy Paper (PRSP 2008-2012) for Sierra Leone recognized the need to provide electricity as one of the key priorities. The need for additional generation capacity and modernization and extension of transmission and distribution grids was already discussed above in the section on the electricity sector.

The Bumbuna Hydroelectric Power Project was completed and commissioned in November 2009. It continues to provide improved electricity supply to the city of Freetown and its environs, despite the transmission and distribution difficulties in the network.

To increase generation, a 10-Mega Watt thermal plant was installed at the Kingtom Power Station between 2007 and 2010 with technical and financial assistance from the Japan International Cooperation Agency. With support from the Arab Bank for Economic Development in Africa, two diesel-powered machines of total output capacity of 16.5MW were also been installed in March 2011 at Black Hall Road in Freetown. Together, these machines are giving a considerable supplementary boost to the Bumbuna power system, providing a total installed capacity of 76MW of electricity supply to the city.

In the provincial towns, there was a proposal for a 6MW thermal plant to be constructed in Makeni city with capacity to supply electricity to Matotoka and Magburaka townships in the Northern Province. While that project is currently on hold, Makeni city has been connected to the 161Kv transmission line through the shield wire scheme. The construction of the transmission line from Makeni to Magburaka is in progress. A 6MW thermal plant is under construction / erection at Lungi to provide power to the Freetown International Airport and the surrounding towns. Arrangements are now well underway for installation of the plant and construction of its distribution and transmission networks. Government has also embarked on the construction of a 6MW thermal plant in Koidu, including its distribution and transmission network systems.

Additionally, Government has rehabilitated one of the three thermal plants at the Bo Power Station with a capacity of 1.9MW and there is also an emergency plant provided by Addax of about 1.7MW, these thermal plants currently are supplementing the 6MW mini-hydro at Goma-Dodo in the Kenema District. Other thermal generating plants and distribution and transmission networks are also planned for other provincial headquarter towns throughout the country.

A Public Private Partnership Agreement has been signed by Government and Blue Flare Power for the construction of thermal plants with installed capacity of 1000MW including their associated distribution and transmission networks on a “Build Operate, and Transfer” basis. Phase I of the project is the construction of a 125-Mega Watt thermal plant and its associated network for the Western Area. The construction period for Phase I is 18 calendar months while the duration of the entire project is five years. With a concessionary loan from China, the Government is commencing the construction of mini-hydro power stations in Charlotte (2.2MW) and Makali (0.12MW). A

technical design and draft contract for the construction of Bankasoka Hydro Power Station in the district headquarter town of Port Loko has also been concluded with another Chinese company.

Besides the improvement of the national electricity system, there is a need to work on sustainable off-grid solutions in the rural areas. This refers to several aspects such as provision of lighting for rural area and access to mechanical or motive power.

2.1.2 ACCESS TO MECHANICAL POWER

There are some Multifunctional Platforms (MFP)³ available in Sierra Leone, which are mainly used for electricity generation and agro-processing. There is a need to conduct additional pilot programmes supporting the introduction of MFPs in rural areas and targeting e.g. cooperatives and women organisations. Programmes should include training and support provided to artisan networks and women organisations on installation and maintenance of MFPs. They will also require support and implementation of credit strategies. Lessons learned in these pilot programmes should flow into the design of more extensive programmes for rural communities.

The implementation of MFP enterprises could provide opportunities for income generation and workload reduction to women, benefiting them and their children. MFP programmes could be combined with functional literacy courses and vocational training.

Given the impact of potential diesel price hikes/shortages on the running of the MFPs, it is necessary to evaluate the feasibility of running MFP on biofuels.

2.1.3 ACCESS TO ELECTRICITY

Access to the electricity grid connection was 9% in 2011 and is increasing at a slow pace as shown in Table 15. The advent of Bumbuna Hydro Power supply in the last quarter of 2009 to Makeni and Freetown contributed to the slight increase to access of grid power.

³ A Multi-functional Platform (MFP) typically consists of a diesel engine which powers various end use equipment such as grinding mills, huskers, small electricity generators, battery chargers, pumps, welding and carpentry machines.

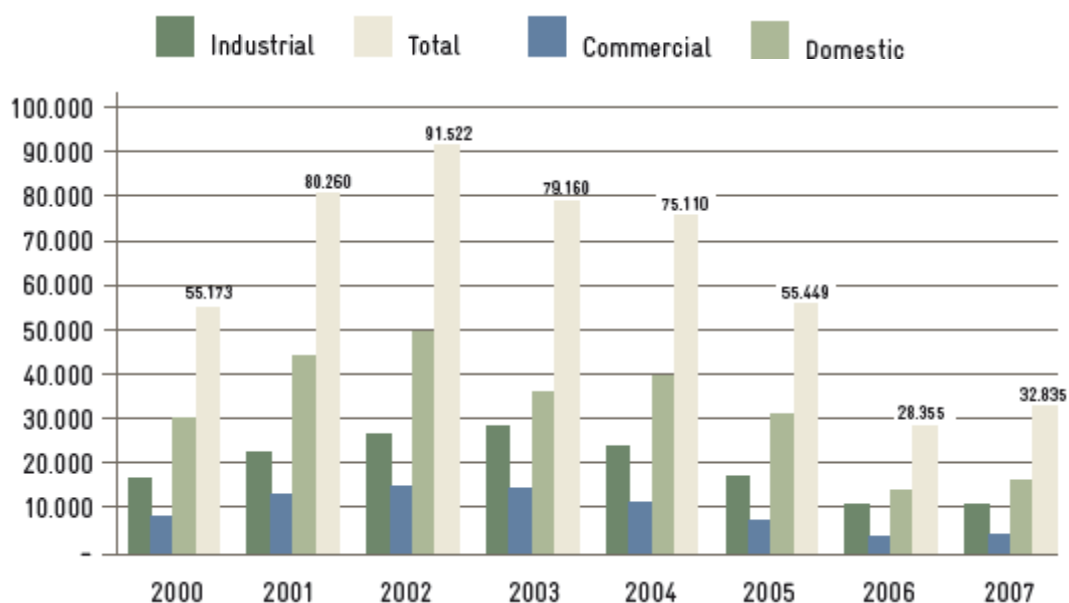
Table 15: TREND OF ACCESS TO GRID CONNECTED ELECTRICITY IN SIERRA LEONE (2006 – 2011)

POPULATION	2006	2007	2008	2009	2010	2011
Freetown	38,362	47,281	53,126	64,306	67,422	73,551
BO-Kenema	8,762	9,078	9,455	10,180	11,302	12,593
Makeni customers	305	430	521	596	602	1,040
Total Customer	47,429	56,789	63,102	75,082	79,326	87,184
Population connected Grid	284,574	340,734	378,612	450,492	475,956	523,104
Population without Grid connection	4,937,426	5,009,266	5,106,388	5,173,508	5,294,644	5,478,896
% ACCESS	5.5	6.4	7.4	8.7	8.2	8.7~9

Source: Statistic Sierra Leone (2012), NPA, MEWR and BKPS (2012)

Electricity consumption by sector for the period 2000-2007 is presented in the figure 2 below. ⁴As can be seen, the largest consumption of electricity takes place in the residential sector, followed by the industrial and commercial sectors, respectively. This consumption pattern remains the same for 2011.

Figure 2: Electricity Consumption Pattern by Sector MWh; (2000-2007)



Source:NPA Management (2010).

⁴ NPA Management.

2.2 ENERGY EFFICIENCY vis-à-vis SEFA GOALS

2.2.1 BRIEF INTRODUCTION

The potential for energy efficiency improvements in Sierra Leone is great. Primary energy consumption per capita stands at 0.25 toe. There is considerable room for improvement in the various energy sub sectors. Energy constitutes a large proportion of the country's GDP costs, and a considerable percentage of household energy expenditure. Pursuing Energy Efficiency (EE) measures will contribute significantly to savings. Fuel substitution could also reduce the negative impact of the use of some fuels on the environment and reduce the cost of energy services.

In the demand sub-sectors, the need for increasing access, promoting the use of more efficient and cleaner energy sources and equipment, as well as of widely available renewable energy resources cannot be over-emphasized. For the household sector, Government has placed emphasis on the promotion of LPG as a cooking fuel as well as wider dissemination of fuel-saving stoves, and the adoption of renewable technologies. For agriculture and fisheries, the need for the provision of energy sources including renewable energy sources to stimulate mechanization should be addressed. In the commercial sub-sector, focus is on more efficient energy devices for communal cooking and heating and for lighting.

A review of the energy sector in Sierra Leone reveals that poor efficiency plagues almost every energy sub-sector. For instance, over 45 percent of the electricity generated in the Western area remains unaccounted for; while traditional methods of firewood and charcoal have efficiencies below 30 percent. Low efficiencies mean unnecessary waste that cannot be afforded in a country in which energy supplies are well below the suppressed demand.

Energy efficiency and conservation, besides saving energy will also be encouraged as a means towards cleaner production and pollution control measures in industries. There is a need for performance benchmarks and energy audits in the industrial and commercial/service sectors. The introduction of demand side management practices will create opportunities for energy savings in the electricity sub-sector.

2.2.2 MEASURES TO IMPROVE ENERGY EFFICIENCY IN SIERRA LEONE

The following measures were outlined in the Government of Sierra Leone National Policy Document of 2009.

(a) Reduce energy losses through up-grading of power transmission and distribution systems and also through human theft;

- (b) Promote the use of energy efficient equipment and technologies;
- (c) Encourage the use of equipment for power factor correction in industries and homes;
- (d) Promote the development and introduction of improved fuel-saving kerosene, charcoal and wood stoves;
- (e) Launch an awareness campaign to sensitise consumers of the importance of energy efficiency and its relationship to productive use and economy of scale of investment.
- (f) Promote capacity building on energy auditing and efficiency analysis.
- (g) Introduce an **Energy Efficiency and Conservation Act** that would spell out mandatory energy management practices, building codes, requirements on energy efficiency levels of energy consuming equipment, energy audit regimes for formal industries and commercial entities.

2.2.3 SMART TIPS:

The following tips were formulated by energy consultant and author of this report.

- **Technologies to be used** - Power factor correction, Compact Florescence Lamps (CFL) Lamps, Solar (PV & Thermal), Biogas, Biomass, Pico & Mini Hydro,
- **Process to follow** - Training of benefactors , Auditing of system
- **Application to the Industries** - Food Production, Processing & Storage, Education, Health Care, Drinking Water, Communities/Social Services, Cottage Industries
- **Benefits to the Public** - Social Services, Street Light, Computer, Internet, Income Generating Activities
- **Challenges to Overcome** - Funding, Capacity Building, Awareness, Co-ordination, Technology, Institutional, Political, Legal.

2.3 RENEWABLE ENERGY vis-à-vis SEFA GOALS

2.3.1 BRIEF INTRODUCTION

Sierra Leone's energy demand is characterized by a low per capita consumption of petroleum and thermal electricity energy and a high dependence on renewable energy including biomass fuels in the form of firewood, charcoal and bio-waste. Biomass will remain the main energy source for the foreseeable future. However, apart from biomass, there are other potential renewable energy sources available for exploitation. These include small-hydro, geothermal, wind and solar.

The country has vast renewable energy potential to complement and sustain its energy needs, but there have been several barriers in the way of harnessing these resources in a productive and meaningful way. There is neither the appropriate technology nor the indigenous capacity to design, manufacture, market, distribute, and install Renewable Energy Technologies (RETs). To compound the problem, there has been insignificant investment and interest shown by both the Government and commercial operators in the advancement of RETs.

There is a need to develop Government initiatives to overcome the economic, cultural and safety barriers to improve efficient conversion and end-use practices. By developing initiatives to improve standards, the health hazards will be minimized and the environment will be better protected.

Development of RETs should be mobilized by instituting the relevant legally-backed conceptual framework with the necessary administrative and financial resources to establish standards, guidelines and codes of practice and norms for the safe exploitation and use of RETs in an environmentally friendly fashion.

2.3.2 BIOMASS

Biomass is the main source of energy in use in households in Sierra Leone, mainly in the form of fuelwood and charcoal, while the use of agricultural crop residues remains limited. Biomass potential is high, particularly from forest resources. In 2011, it is estimated that the public consumed 1,262,000 toe. This quantity is equivalent to 14,674GWh (based on population base line of 3.52 million, growth rate of 3.3% in 2011, per capita consumption of 0.42m³/cap/ annum and 0.11m³/cap/ annum for fire wood and charcoal respectively) Conteh (1997) and Statistic Sierra Leone Publication (1995). Potential feed stocks include rice husks and straw.

Sierra Leone is collaborating with the UN FAO Bioenergy and Food Security Project (BEFS). An analytical assessment framework has been developed by FAO to support decision-making on bio-energy and specifically, assessing conflicts between bio-energy and food supply. This framework has been implemented by FAO in Thailand, Peru, Tanzania, and is being implemented in Sierra

Leone. The framework addresses impacts on water and forests among other important variables. In Sierra Leone, besides the implementation of the analytical framework, a platform was created in order to allow staff from the different ministries involved in bioenergy to work together and exchange experience and information in order to facilitate convergence and coordination in the development and implementation of programmes in the bioenergy sector and perform resource assessments.

2.3.3 ETHANOL PRODUCTION

There has been substantial interest from investors in building ethanol fuel plants for exporting. Addax Bioenergy is the first of these initiatives that has materialized. The project will produce fuel ethanol from sugarcane for exports and electricity for injection into the grid, using the residual bagasse. It will produce about 90,000 m³ of ethanol per annum, primarily for export to the European Union (EU) market and 32 MW of electricity generation, of which about 15MW will be fed into the national grid.

Addax Bioenergy is a public-private partnership, financed by up to 7 banks including the African Development Bank and World Bank. This has forced the company to comply with stricter performance indicators than would typically be adhered to by a project developer using other financial sources. For instance, Addax Bioenergy conducted an extensive analysis of the environmental, social and health impacts of the project. It also conducted a public land lease process. As part of the land lease process, acknowledgment agreements are signed directly with traditional landowners who acknowledge Addax Bioenergy's rights under the land leases. In return the landowners receive an annual direct rent payment.⁵

The Addax project also includes a Farmer Development Programme (FDP). This FDP divides land into community fields established and sown by Addax Bioenergy and dedicated to rice and cassava production for the benefit of the local population. The FDP programme was developed with the support of the UN Food and Agriculture Organization (FAO) with the aim of securing the per capita food baseline in the project area.⁶ A sub-component of the FDP is the so-called Farmer Field and Life School (FFLS) to improve agricultural skills, and increase food security for subsistence for project-affected communities. Each affected village is eligible for FFLS training and mechanisation and extension services. Participants, of which a majority are women, meet on a weekly basis to

⁵ Addax Bioenergy Factsheet. Bioenergy and Food Security Criteria and Indicators (BEFSCI). UN Food and Agriculture Organization (FAO).

⁶ EXECUTIVE SUMMARY OF THE COMPREHENSIVE RESETTLEMENT POLICY FRAMEWORK AND THE PILOT PHASE RESETTLEMENT ACTION PLAN Project. Addax Bioenergy Project. Sierra Leone. P-SL-AAG-002. African Development Bank Group

increase their knowledge of issues such as pest control, usage of farmer produced compost and fertilizer.

During its development, the project has been primarily overseen by the Ministry of Agriculture Forestry and Food Security (MAFFS). After electricity generation from bagasse was contemplated as an option, the MEWR became involved.

After facing difficulties finding skilled labour, Addax Bioenergy has shown interest in training technicians and other personnel in Sierra Leone in order to hire them to work in the facility.

Other companies are interested in building ethanol plants in Sierra Leone, with the main purpose of serving the EU market. Guidelines for investors are urgently required and are currently being drafted by FAO.

2.3.4 PALM OIL PRODUCTS

According to the Sierra Leone Investment and Export Promotion Agency (SLIEPA),⁷ there could also be potential for palm oil plantations. Palm oil could be use as cooking oil or could be converted to biodiesel. This biodiesel could be used as a cooking fuel or as transport fuel. Moreover, electricity can be generated at oil palm mills from methane captured from effluent ponds and from crop residues

At present, most palm-oil is produced locally using traditional techniques while palm oil imports are increasing rapidly. Palm oil products could be used to supply the domestic market, in which demand for vegetable oil is rapidly increasing, and substitutes for firewood and charcoal as cooking fuels and new sources of electricity production are urgently required. Palm oil products could also generate export opportunities in the ECOWAS regional market. Under ECOWAS agreements, palm oil and biodiesel produced in Sierra Leone would have unrestricted duty-free access to all countries in the region. Palm oil production at a larger scale than today would need to comply with environmental and local development criteria.

2.3.5 AGRICULTURAL RESIDUES

The main crops in the country are rice, cassava, palm oil, sugar cane, cocoa beans and coffee beans among others. These crops are mainly for internal consumption. Since agricultural practices are still very traditional, domestic production does not cover demand and a number of products are imported. The investment policy review of Sierra Leone conducted by UNCTAD in 2010 estimated the production of key crops as summarized in table 16.

⁷ SLIEPA: Sierra Leone Investment Outreach Campaign. Opportunities for Investors in the Oil Palm Sector Update: February 2010.

Table 16: Production of Key Crops (in thousands of tons)

Crop	1990	1995	2000	2003	2006
Cassava	123	219	241	325	350
Cocoa beans	24	10	11	12	14
Coffee, green	26	25	15	17	18
Oil palm fruit	250	225	175	195	195
Rice, paddy	504	356	199	446	1062

Source: Food and Agriculture Organization of the United Nations (FAO) Statistics Division, 2008 cited by Investment Policy Review Sierra Leone. United Nations Conference on Trade and Development (UNCTAD). 2010

Agricultural residues are abundant (rice husks, rice straw, cocoa husk, etc.). However, there have not been any efforts to use these residues for energy purposes. If tapped, these sources could provide significant energy.

Cassava appears to be a promising feedstock for energy uses. The waste water, peelings and solid residues from cassava processing could be used for biogas production. Cassava appears to be a good “food security crop”, since it is able to produce high yields under poor conditions and stores the usable portion underground.⁸ One of the main products from cassava roots in Sierra Leone is Gari, a granular flour that can be used for bread production and other purposes. The transition of cassava from a “food-security-crop” to an income-generating commodity has only begun recently. Training for actors along the cassava value chain (farmers, processors) would be required, in order to increase the scale of commercial production. Thus, initiatives focusing on the cassava value chain may prove beneficial as an income-generation activity for rural communities and as a potential source of feedstock for biogas.

Biogas has not been explored as an option so far in Sierra Leone. People tend to find the feedstock unappealing and have reservations to use it. Its introduction would require targeted education efforts in order to make people familiar with the technology and its benefits.

⁸ L.O. Sanni, O.O. Onadipe, P. Ilona, M.D. Mussagy, A. Abass, and A.G.O. Dixon. Successes and challenges of cassava enterprises in West Africa: a case study of Nigeria, Bénin, and Sierra Leone. International Institute of Tropical Agriculture (IITA), common Fund for Commodities (CFC), 2009

2.3.6 HYDROPOWER

This is a major energy source, holding great promise for Sierra Leone, which possesses several rivers that could be exploited for electricity. According to the Power Sector Master Plan (1996), 27 potential hydropower sites with a total capacity of 1,513 MW have been identified. However, except for two sites (Bekongor and Bumbuna), all of the others suffer from water flow rate variations between the wet and dry seasons. Yiben II, Bekongor III, Kambatibo, Betmai III, Yiben I and Bumbuna Falls are the most attractive projects in terms of generation cost. These sources remain virtually untapped as of date.

To date, Sierra Leone has built three hydroelectric plants:

- The 2.4 MW Guma plant installed in 1967 in the Western Area, which was decommissioned in 1982
- The 6 MW run-of-the river hydro power plant, Dodo, located in the Eastern Province, some 380 km from Freetown and 69 km from the headquarter town of Kenema, and
- The 50MW Bumbuna Plant located at Bumbuna Town in the northern part of Sierra Leone which is about 204km from Freetown

The Dodo Hydro plant is functional and is operated by the BKPS and is a part of a regional grid connecting thermal power plants in Bo and Kenema while the Bumbuna Hydro Plant is operated by an O&M Operator and feeding Freetown and its environs through 161Kv line with a shield wire scheme supplying power to Makeni city and Bumbuna Village.

Although many of the rivers investigated fall under the small to medium hydro classification (i.e. 1 – 100 MW) there is a potential for pico to mini hydro systems (5 kW to 1MW). The Master Plan, however, is silent on potential resources under 2 MW. This is expected to be an area of huge potential for public-private partnerships and wider investment by the private sector. On account of this dearth of data on such small capacities, between 2006 and 2007 the Ministry collaborated with GTZ – Sierra Leone to conceive of a basic study designed to gather hydrological data to feed into the design of small hydro projects with capacities of up to 1 MW. This study has not yet been executed.

A well-advanced plan exists for the construction of one Small Hydro Power Plant (1 MW) in Port Loko. The design has been completed and the project implementation will start soon. This project is funded by the Chinese Government, UNIDO and GOSL. The government has recently signed an agreement with the Chinese government for the development of facilities in Charlotte (2.2MW) and

Makalie (0.12MW). Chinese contractors have already mobilized and the work is progressing. A synopsis of potential hydro sites in Sierra Leone is shown in Table 17 below.

Table 17: Synopsis of Potential Hydro Sites in Sierra Leone

Project	River	Potential Capacity (MW)	Installed Capacity (MW)	Energy Generation (GWh/year)	Specific Energy Cost (USD cents/kWh)
Benkogor III	Sewa River	85,5		513,1	3,7
Benkogor II	Sewa River	80,0		413,8	6,8
Benkogor I	Sewa River	34,8		237,2	7,2
Mange I	Little Scarcies	35,2		244,1	5,7
Mange II	Little Scarcies	12,8		108,6	7,2
Tendata	Little Scarcies	28,6		211,4	6,5
Kuse I	Little Scarcies	28,0		99,3	32,1
Kuse II	Little Scarcies	91,0		679,7	5,9
Maka	Little Scarcies	21,0		113,5	11,1
Kumba	Little Scarcies	48,9		302,8	8,1
Kambatibo	Little Scarcies	65,7		322,1	4,9
Kabala Falls	Seli River	2,4		7,6	29,0
Rokon	Seli River	31,8		136,5	14,0
Bumbuna Falls	Seli River	26,8		205,8	5,7
Yiben I	Seli River	61,5		442,9	5,7
Yiben Falls II	Seli River	62,1		430,2	3,9
Komoia	Seli River	10,8		61,6	11,9
Betmai III	Pampana River	36,6		249,5	4,9
Betmai I	Pampana River	52,5		268,5	5,9
Betmai II	Tala River	60,0		269,9	8,1
Titana	Sewa River	22,2		95,9	13,0
Levuma	Sewa River	7,8		59,0	14,9
Banda Karafain	Sewa River	7,8		54,1	8,6
Goma	Sewa River	9,8		49,6	14,9
Baraka	Moa River	39,6		233,8	8,2
Nyandehun	Moa River	6,4		49,4	7,4
Moyamba	Gbangbai River	4,4		21,8	19,5

Source: Sierra Leone Master Plan Study Report (1996).

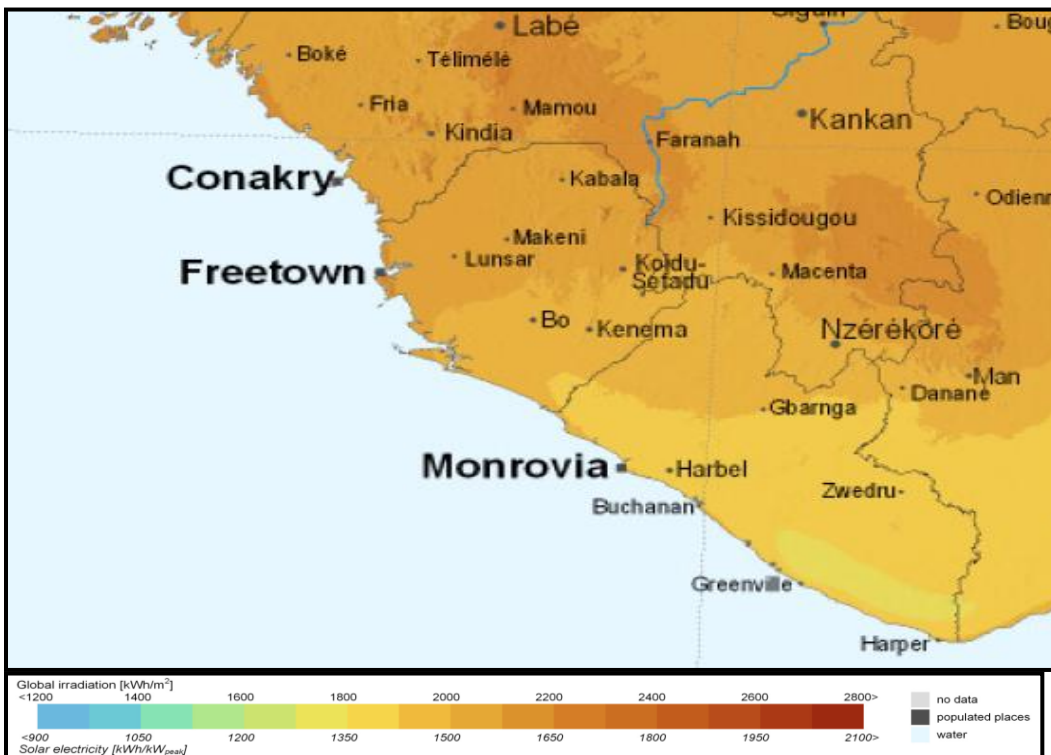
Joule African contracted Lahmeyer International to conduct a bankable feasibility study for further development of Bumbuna I extension and phase II to deliver a total output capacity of 389MW. This is progressing to the geotechnical studies stage. In addition, in the Moyamba district, a site for a 10MW hydropower dam has been proposed. The site has been assessed by UNIDO. The plant could serve the Moyamba district, Njala and parts of Bo district.

Due to strong differences in water inflows to rivers in the wet and dry seasons, there is a need for complementary generation options that at least partially compensate the loss of hydro generation capacity in the dry season. In this regard, there could be possibilities for hybrid hydro/solar plants in the future.

2.3.7 SOLAR ENERGY

According to the Ministry of Energy and Water Resources (MEWR), approximately 1460 kWh/m of solar radiation can be expected annually in Sierra Leone⁹. A more optimistic study undertaken by the Joint Research Centre (JRS) of the European Commission portrays Sierra Leone’s solar potential to be as high as 2200 kWh/m¹⁰. Figure 3 clearly shows the solar radiation potential in Sierra Leone.

Figure 3 Map of Sierra Leone



Source: Africa Solar Potential, 2008.

⁹ Solar Energy Initiatives. Ministry of Energy and Water Resources, 2011

¹⁰ Photovoltaic Solar Electricity Potential in the Mediterranean Basin, Africa, and Southwest Asia. Suri M., Cebecauer T., Huld T., Dunlop E.D., Wald L., Albuissou M.. Joint Research Centre. 2008

Solar energy could contribute to a number of energy uses such as lighting, refrigeration, battery charging, cooking and water heating. It could thus have a positive impact on the development of communities, facilitating improvements in hygiene, education, safety, communication and qualification, among others.

Although solar photovoltaic systems were in extensive use prior to the civil conflict (mainly in telecommunications industries and repeater stations), many of these systems were destroyed during the conflict and only an installed capacity of approximately 32 kW remains in operation^{11 12}.

The MEWR has identified that in order to develop solar technologies in Sierra Leone, among others the following activities should be conducted¹³:

- Identify the solar energy options that are best suited for Sierra Leone and assess their potential
- Implement policies for solar power market creation through private actors. In this regard, best practice and lessons learnt from the private sector involvement in solar energy business in the other African countries could be helpful
- Establish networks between solar power companies and Sierra Leone counterparts
- Pursue partnerships with other institutions to undertake joint investments in rural energy production through solar technology

Some programmes for the promotion of solar energy have been implemented or are currently being developed. For instance, a project for the installation of 10.000 solar street lights in Freetown, Lungi and 12 district capitals is being developed. The project is being financed by the ECOWAS Bank for Investment and Development and own funds of the Government of Sierra Leone. The solar street lights will be stand-alone units using Light Emitting Diodes (LEDs).

In addition, two pilot projects on solar electrification of rural villages were undertaken. In the Tombo village, a project funded by the University of Sierra Leone and completed in 2008, enabled solar installations powering a radio station, a health clinic and a secondary school. In the village of Konta Line, the NGO Safer Future Youth Development Project (SFYDP) undertook a project to provide 28 homes with solar installations. Each home is provided with a 36 W solar panel on the

¹¹ Solar Energy Initiatives. Ministry of Energy and Water Resources, 2011

¹² Potential Solar Energy Applications in Sierra Leone. Ministry of Energy and Water Resources. 2010.

¹³ Solar Energy Initiatives. Ministry of Energy and Water Resources, 2011.

roof, 12 volt batteries with 40 amps, two lamps, one lantern and a solar outlet for charging mobile phones.

A related project addressed the promotion of solar energy in rural areas, with a programme targeted at women. With the help of the Barefoot College from India, the so-called “barefoot initiative” supported the construction of a solar training centre in the village of Konta line. The centre seeks to provide training for illiterate women in rural communities in the building of solar photovoltaic lanterns and installation of solar panels. The project is being undertaken as a joint effort of the government of Sierra Leone and the Indian government. Women are chosen by their communities and sent for training to the centre. An initial training of a small number of women has already been conducted, with partial training in Sierra Leone and India, respectively. This group of women will act as a multiplier for training of additional women in the future. The government of Sierra Leone has expressed its intention to replicate the project in other regions of the country.

UNIDO has established growth centres, which support the economic recovery in the concerned communities. These growth centres support communities with food-processing machines, metal works such as blacksmiths and a warehouse. In 5 established growth centres, 7 solar photovoltaic facilities have been installed for demonstration purposes and to provide power to strengthen the centres` services. Other 52KW solar facilities are being installed by UNIDO in rural areas. The specific purpose is to provide power for motors in the centre and support business in the evening hours.

Other solar energy projects have been undertaken at clinics and hospitals. For example, the Beacon Solar Energy Project in Sierra Leone was designed to help improve the care at an amputee clinic in the eastern Kono region. The installed solar panels allowed the use of more adequate medical equipment. Also, at the Masanga Leprosy Hospital, kerosene and head lamps were replaced by solar power. In addition, a submersible solar pump to gather water and a solar water heating system were installed. This latter project was undertaken by the Environmental Foundation for Africa (EFA).

A promising development is the fact that Small and Medium Enterprises (SMEs) and other entrepreneurs are engaging in promoting urban solar PV solutions to commercial and private customers in the Freetown area in an effort to create a market for this technology and raise awareness. An obstacle for the development of this business is the lack of qualified technicians, capable of installing, maintaining and repairing solar PV systems. Middle level training for technicians is required.

UNDP and three private companies facilitated the installation of 30 PV solar panels and equipment in senior secondary schools in strategic rural settings between 2010 and 2011 by utilising the Delivery as One (DaO) funds under Joint Vision Programme 18.

2.3.8 WIND ENERGY

Data on wind speeds across Sierra Leone are rare. Existing data on wind velocities indicate a country-wide average of between 3 m/s and 5 m/s. There is some indication that wind speeds of 12 m/s are possible in parts of the country, implying that wind energy could be a viable option in selected locations. There is currently no wind energy system in Sierra Leone.

However, the Ministry of Energy and Water Resources is encouraging studies of sites that may hold potential. With wind turbines capable of operating with low wind speeds now on the market, there is a strong potential for these systems in rural areas, especially in the north. Potential may also exist for off-shore wind generation facilities.

2.4 SEFA GOALS

2.4.1 STRATEGY FOR PROVIDING SUSTAINABLE ENERGY FOR ALL

Access to modern energy, including electricity, in Sierra Leone is severely limited. In order to reach the SEFA goals, a strategy needs to be undertaken to examine the various sub-sectors and different areas (urban, peri-urban and rural). The table 18 (below) summarizes the strategy to be adopted for Sierra Leone. As can be seen, a number of actors are to be involved in the implementation of the strategy.

The Government of Sierra Leone has set up a Multistakeholders' Group on Energy Access, which brings together all the stakeholders to ensure that efforts are complementary and well-coordinated. It is envisaged that this group will have sub-groups to handle specific activities such as household fuels, biofuels, solar electrification, etc.

Table 18: ACTIVITY PLAN FOR PROVIDING SUSTAINABLE ENERGY FOR ALL

ENERGY SUB-SECTOR	ACTIVITIES	ACTIONS REQUIRED	RESPONSIBLE FOR ACTION	COMMENTS
HOUSEHOLD/COMMERCIAL	Cooking	Develop an LPG programme; Introduce improved cook stoves; Introduce Ethanol gel as cooking fuel; Introduce production and use of briquettes from saw dust, rice husks and other agricultural wastes; R &D of other renewable energy fuel sources.	GoSL GoSL, NGOs, Private Sector GoSL, Private Sector GoSL, Private Sector Universities, Technical Institutes	The GoSL will actively promote the efficient use of fuelwood and charcoal and work with the universities, private sector and MGOs to develop and introduce alternative fuels for household use.
HOUSEHOLD/COMMERCIAL	Lighting and Household	Increase electricity production and access. For	GoSL;	GoSL would need to consider the provision of subsidies for the poor and this should be

ENERGY SUB-SECTOR	ACTIVITIES	ACTIONS REQUIRED	RESPONSIBLE FOR ACTION	COMMENTS
COMMERCIAL	Appliances	<p>urban centres and rural areas close to grid lines, focus will be on extension of the grid to provide electricity; For remote locations, decentralized electricity production is envisaged until such time that it becomes cost-effective to connect to a national or area grid,</p> <p>Promote use of energy efficient technology and equipment.</p>	<p>Electricity Generation and Transmission Company;</p> <p>Electricity Distribution Company;</p> <p>Private Sector</p> <p>GoSL</p>	<p>reflected in the electricity tariff system.</p> <p>GoSL should develop standards for imported household electrical goods</p>
AGRICULTURE /FISHERIES	Food Production	<p>Promote more widespread use of mechanized equipment for</p>	GoSL	

ENERGY SUB-SECTOR	ACTIVITIES	ACTIONS REQUIRED	RESPONSIBLE FOR ACTION	COMMENTS
		dryers and cooling equipment;		
INDUSTRY	Industrial Processes	Increase Electricity Supply	GoSL, Electricity Generation and Transmission Company; Electricity Distribution Company; Private Sector.	
MINING	Mining Processes	Expand and extend electricity supply to mining enterprises	GoSL, Electricity Generation and Transmission Company;	

ENERGY SUB-SECTOR	ACTIVITIES	ACTIONS REQUIRED	RESPONSIBLE FOR ACTION	COMMENTS
			<p>Electricity Distribution Company; Private Sector.</p>	
<p>MINING</p>	<p>Mineral Processing</p>	<p>Promote the use of biomass and energy efficient technology for heating processes</p>	<p>GoSL; Mining Companies</p>	
<p>TRANSPORT</p>		<p>Enforce vehicle testing requirements to ensure that vehicles meet the required levels of efficiency and emissions,</p> <p>Implement an ethanol/fossil blending programme that aims at a 10% replacement of fossil fuel with ethanol for</p>	<p>GoSL (Road Transport Corporation) GoSL (MTA)</p>	

ENERGY SUB-SECTOR	ACTIVITIES	ACTIONS REQUIRED	RESPONSIBLE FOR ACTION	COMMENTS
		transportation.		

Source: National Energy Policy Sierra Leone (2009)

The activities plan for the short, medium and long terms are given in tables 19, 20, 21 respectively. These plans are in line with those in the National Strategic Energy Policy of 2009.

Table 19: ACTIVITIES PLAN FOR THE SHORT TERM [2012 – 2015]

	BASELINE	Domestic	Comm./Service	Agriculture	Industry	Mining	Transport
Access to Electricity (Grid Connection)	<ul style="list-style-type: none"> i. The current national access is 9 % ii. Penetration of solar PV is almost zero 	<ul style="list-style-type: none"> i. 30% access ii. 90% uninterrupted electricity supply ii. To achieve 1% penetration of solar home systems 	<ul style="list-style-type: none"> i. 100% access ii. 90% uninterrupted electricity supply ii. To achieve 1% penetration of solar PV in hotels, guest houses, and restaurants 	<ul style="list-style-type: none"> i. 40% access ii. 90% uninterrupted electricity supply ii. To achieve 1% penetration of solar PV for lighting and 1% solar water pumping for irrigation 	<ul style="list-style-type: none"> i. 100% access ii. 90% uninterrupted electricity supply ii. Providing a cost recovery and sustainable electricity price 	<ul style="list-style-type: none"> i. 100% access ii. 90% uninterrupted electricity supply ii. Providing a cost recovery and sustainable electricity price 	<ul style="list-style-type: none"> i. Installation of traffic lights in the Western Area Bo, Kenema and Makeni
Energy for Cooking, Heating, Cooling and Drying	<ul style="list-style-type: none"> i. Share of wood is 86% ii. Use of energy efficient cook stove is insignificant ii. Share of kerosene is 2.7% v. LPG share 0.1% 	<ul style="list-style-type: none"> i. To reduce the share of fuelwood by 10% ii. Increase the penetration of energy efficient cook stove to 5% ii. Increase the share of kerosene to 30% v. Increase the share of LPG to 5% 	<ul style="list-style-type: none"> i. To reduce fuelwood share to 50% ii. Increase the penetration of energy efficient cook stoves by 5% ii. Increase LPG share by 30% iv. Achieving 1% penetration of SWHs in hotels, guest houses and restaurants 	<ul style="list-style-type: none"> i. To achieve 1% penetration of solar dryers for crop drying ii. 50% penetration of refrigeration systems for food and vaccines preservation 			
Petroleum Products	<ul style="list-style-type: none"> i. No strategic stock at present ii. No bio-fuels and complementation of fuels 	<ul style="list-style-type: none"> I. Achieve strategic stock capacity of refined products for 6 – 8 weeks of national demand 	<ul style="list-style-type: none"> I. To achieve strategic stock capacity of refined products for 6 – 8 weeks of national demand 	<ul style="list-style-type: none"> I. Achieving 1% penetration of bio-fuels for motive power II. Achieving strategic stock capacity of refined products for 6 – 8 weeks of 	<ul style="list-style-type: none"> I. Achieving a strategic stock capacity of refined products for 6 – 8 weeks of national demand 	<ul style="list-style-type: none"> I. Achieving a strategic stock capacity of refined products for 6 – 8 weeks of national demand 	<ul style="list-style-type: none"> I. Allowing 2% alternative complementation fuels II. Achieving a strategic stock capacity of refined products for 6 – 8

				national demand			weeks of national demand
Energy Efficiency	<ul style="list-style-type: none"> i. No efficiency standards for electrical appliances and equipments ii. No monitoring of power factors 	<ul style="list-style-type: none"> I. To achieve 30% penetration of energy efficient refrigerators, freezers and air conditioners, cook stoves and CFLs II. Operating at 90% power factor 	<ul style="list-style-type: none"> I. To achieve 40% penetration in terms of air conditioning and ventilation, hot water supply and lighting. II. Operating at 90% power factor 	<ul style="list-style-type: none"> I. Operating at 90% power factor 	<ul style="list-style-type: none"> I. To achieve 40% penetration for motors and drives, refrigeration, and chilled and cooling water II. Operating at 90% power factor 	<ul style="list-style-type: none"> I. To achieve 40% penetration for motors and drives, refrigeration, and chilled and cooling water II. Operating at 90% power factor 	<ul style="list-style-type: none"> I. Achieving 20% penetration of mass transportation II. Achieving 20% importation of energy efficient vehicles

Source: National Energy Policy Sierra Leone (2009), updated by author of this report (2012).

Table 20: ACTIVITIES PLAN FOR THE MEDIUM TERM [2015 – 2020]

	BASELINE	Domestic	Comm./Service	Agriculture	Industry	Mining	Transport
Access to Electricity (Grid Connection)		<ul style="list-style-type: none"> i. 50% ii. 95% uninterrupted electricity supply ii. To achieve 3% penetration of solar home systems 	<ul style="list-style-type: none"> i. 95% uninterrupted electricity supply ii. To achieve 5% penetration of solar PV in hotels, guest houses and restaurants. 	<ul style="list-style-type: none"> i. 70% ii. 95% uninterrupted electricity supply ii. To achieve 10% penetration of solar PV for lighting and 10% solar water pumping for irrigation 	<ul style="list-style-type: none"> i. 95% uninterrupted electricity supply 	<ul style="list-style-type: none"> i. 95% uninterrupted electricity supply 	<ul style="list-style-type: none"> i. Installation of traffic lights in all district headquarter towns.
Energy for Cooking, Heating, Cooling and Drying		<ul style="list-style-type: none"> i. To reduce the share of fuelwood by 20% ii. Increase the penetration of energy efficient cook stove to 10% ii. Increase the share of kerosene to 60% 	<ul style="list-style-type: none"> i. To reduce fuelwood share to 20% ii. Increase the penetration of energy efficient cook stove to 10% ii. Increase LPG share by 50% 	<ul style="list-style-type: none"> i. To achieve 3% penetration of solar dryers for crop drying ii. 100% penetration of refrigeration systems for food and vaccines preservation 			

		<ul style="list-style-type: none"> v. Increase the share of LPG to 10% v. 0.25% penetration of solar water heater 	<ul style="list-style-type: none"> v. To achieve 1% penetration of biogas in hotels and restaurants v. To achieve 3% penetration of solar water heaters in hotels, guest houses and restaurants 				
Petroleum Products		<ul style="list-style-type: none"> i. Achieving a strategic stock capacity of refined products for 8 –10 weeks of national demand 	<ul style="list-style-type: none"> i. Achieving a strategic stock capacity of refined products for 8 –10 weeks of national demand 	<ul style="list-style-type: none"> i. To achieve 10% penetration for motive power ii. Achieving a strategic stock capacity of refined products for 8 –10 weeks of national demand 	<ul style="list-style-type: none"> i. Achieving a strategic stock capacity of refined products for 8 –10 weeks of national demand 	<ul style="list-style-type: none"> i. Achieving a strategic stock capacity of refined products for 8 –10 weeks of national demand 	<ul style="list-style-type: none"> i. Allowing 10% alternative complementation fuels ii. Achieving a strategic stock capacity of refined products for 8 –10 weeks of national demand
Energy Efficiency		<ul style="list-style-type: none"> I. To achieve 60% penetration of energy efficient refrigerators, freezers and air conditioners, cook stoves and CFLs II. Operating at 95% power factor 	<ul style="list-style-type: none"> I. To achieve 80% penetration in air conditioning and ventilation, hot water supply and lighting. II. Operating at 95% power factor 	<ul style="list-style-type: none"> I. Operating at 95% power factor 	<ul style="list-style-type: none"> I. To achieve 80% penetration for motors and drives, refrigeration, and chilled and cooling water II. Operating at 95% power factor 	<ul style="list-style-type: none"> I. To achieve 80% penetration for motors and drives, refrigeration, and chilled and cooling water II. Operating at 95% power factor 	<ul style="list-style-type: none"> I. Achieving 40% penetration of mass transportation II. Achieving 40% importation of energy efficient vehicles

Source: National Energy Policy Sierra Leone (2009), updated by author of this report (2012).

Table 21 ACTIVITIES PLAN FOR THE LONG TERM [2020 – 2030]

	BASELINE	Domestic	Comm./Service	Agriculture	Industry	Mining	Transport
Access to Electricity (Grid Connection)		<ul style="list-style-type: none"> i. 75% ii. 98% uninterrupted electricity supply ii. To achieve 5% penetration of solar home systems 	<ul style="list-style-type: none"> i. 98% uninterrupted electricity supply ii. To achieve 10% penetration of solar PV in hotels, guest houses and restaurants. 	<ul style="list-style-type: none"> i. 100% ii. 98% uninterrupted electricity supply ii. To achieve 15% penetration of solar PV for lighting and 15% penetration of solar water pumping for irrigation 	<ul style="list-style-type: none"> i. 98% uninterrupted electricity supply 	<ul style="list-style-type: none"> i. 98% uninterrupted electricity supply 	<ul style="list-style-type: none"> i. Installation of traffic lights in all major towns other than headquarter towns.
Energy for Cooking, Heating, Cooling and Drying		<ul style="list-style-type: none"> i. To reduce the share of fuelwood by 30% ii. Increase the penetration of energy efficient cook stove to 15% ii. Increase the share of kerosene to 80% v. Increase the share of LPG to 15% v. 1% penetration of solar water heater 	<ul style="list-style-type: none"> i. To reduce fuelwood share to 10% ii. Increase the penetration of energy efficient cook stove to 15% ii. Increase LPG share by 80% iv. To achieve 2% penetration of biogas in hotels and restaurants v. To achieve 5% penetration of solar water heaters in hotels, guest houses and restaurants 	<ul style="list-style-type: none"> i. To achieve 5% penetration of solar dryers for crop drying 			
Petroleum Products		<ul style="list-style-type: none"> i. Achieving a strategic stock capacity of 	<ul style="list-style-type: none"> i. Achieving a strategic stock capacity of refined products for 10 –12 	<ul style="list-style-type: none"> i. To achieve 15% penetration for motive power ii. Achieving a 	<ul style="list-style-type: none"> i. Achieving a strategic stock capacity of refined products for 10 –12 	<ul style="list-style-type: none"> i. Achieving a strategic stock capacity of refined products for 10 – 	<ul style="list-style-type: none"> i. Allowing 15% alternative complementation fuels

	BASELINE	Domestic	Comm./Service	Agriculture	Industry	Mining	Transport
		refined products for 10 –12 weeks of national demand	weeks of national demand	strategic stock capacity of refined products for 10 –12 weeks of national demand	weeks of national demand	12 weeks of national demand	ii. Achieving a strategic stock capacity of refined products for 10 –12 weeks of national demand
Energy Efficiency		I. To achieve 80% penetration of energy efficient refrigerators , freezers and air conditioners , cook stoves and CFLs II. Operating at 98% power factor	I. To achieve 100% penetration in air conditioning and ventilation, hot water supply and lighting. II. Operating at 98% power factor	I. Operating at 98% power factor	I. To achieve 100% penetration for motors and drives, refrigeration, and chilled and cooling water II. Operating at 98% power factor	I. To achieve 100% penetration for motors and drives, refrigeration, and chilled and cooling water II. Operating at 95% power factor	I. Achieving 60% penetration of mass transportation II. Achieving 60% importation of energy efficient vehicles

Source: National Energy Policy Sierra Leone (2009), updated by author of this report (2012).

2.4.2 PROJECTION OF PLANNED TARGETS

Below are the SEFA Goals planned for the Short, Medium and Long Term. The activity plan under these periods is outlined below including projection for generating install capacity.

Table 22 SUMMARIES OF PLANNED TRAGETS BASED ON AVAILABLE RESOURCES

SEFA PILLARS	2011	Short Term 2012 – 2015	Medium Term 2015 - 2020	Long Term 2020 – 2030
Energy Access % (Access to Electricity)	9	30	75	100
Energy Efficiency % (Electricity System Gains)	45	60	80	85
Renewable Energy (Biomass, Hydro, solar) ‘000’toe	1,276	1,555 (20%)	3,072 (97%)	7,232 (134%)

Source: MEWR, NPA, MAFFS, Tarawalli, P. Energy Consultant (2012).

Table 23 ELECTRICITY INSTALL CAPACITY PROJECTION FOR SIERRA LEONE (2012 – 2030)

Proposed Electricity Supply Capacity	Short Term (2012 – 2015)	Medium Term (2015 – 2020)	Long Term (2020 – 2030)
Conventional Power (MW)	367.5	745.75	1,080.75
Renewable Power (MW)	101.57	659.57	1,228.37
WAPP	-	80	280
Others Mix Power	100	500	700
Grand Total (MW)	569.07	1,985.32	3,389.12
National Power(MW)	124.17	704.32	1,283.12
Private Section Power (MW)	211.9	301	376
Mining Sector Power (MW)	133	400	650

Source: MEWR, NPA, Mining Companies, NRA, BKPS & SPU (2012)

Table 24: SHORT TERM CONVENTIONAL THERMAL AND RENEWABLE POWER SUPPLY PROJECTION FOR SIERRA LEONE (2012 – 2015)

POWER SUPPLY SOURCE	PLANT SITE	INSTALL CAPACITY (MW)
CONVENTIONAL THERMAL POWER	NIIGATA – KINGTOM	10 (2X5MW) **
	WATSILA – BLACKHALL	17 (2X8.5MW) **
	MAKENI /MAGBURAKA	6 (3X2MW) 2MW **
	PORT LOKO/LUNSAR	3 (2X1.5MW)
	KAMBIA/ROKUPR	1 (2X0.5MW)
	LUNGI	6 (2X3MW)
	KONO	6 (3X2MW)
	BO/KENEMA	5.0 **
	MOYAMBA	2 (2X1MW)
	BONTHE	1 (2X0.5MW)
	PUJEHUN	0.5 (2X0.25MW)
	KAILAHUN	0.5 (2X0.25MW)
	KABALA	0.5 (2X0.25MW)
	SIERRA RUTILE	40
	AFRICA MINERALS LIMITED	29
	LONDON MINING LIMITED	14
	ADDAX BIOENERGY	2
	Isolated Private Diesel Generator (Auto-Generation) plus two years (2010 & 2011) generator imports.	174 (135MW + 39MW) ***
	KOIDU HOLDINGS	12
	CLUFF GOLD	1.5

	SHAMSHI STEEL	50
	SUB-TOTAL MW	393.5
RENEWABLE POWER	HYDRO BUMBUNA (I)	50**
	GOMA DODO HYDRO	6**
	MAKELIE	0.12
	CHARLOTTE	2.2
	MAGBAS SUGAR COMPLEX	3.9
	AADAX	32
	Yele	0.25
	BANKASOKA	2
	SOLAR PV's	5.0
	SUB-TOTAL	101.57
OTHER POWER OPPORTUNITIES		100
GRAND TOTAL (MW)		582.57

Source: MEWR, NPA, NRA, SPU and BKPS (2012)

Note 1: ** Plant in Operation as at May, 2012 with Installed Capacity of **90MW**.

Note 2: Sulzers, Mirrelees and Mitsubishe Plants located at Kingtom Power Station to be De- commissioned.

Note 3:*** NPA Registered license Generator plus 2010 & 2011 Imported Generators Recorded by NRA Customs.

Table 25: MEDIUM TERM CONVENTIONAL THERMAL AND RENEWABLE POWER SUPPLY PROJECTION FOR SIERRA LEONE – (2015 – 2020)

POWER SUPPLY SOURCE	PLANT DESCRIPTION	INSTALL CAPACITY (MW)
CONVENTIONAL THERMAL POWER	NIIGATA – KINGTOM	10 (2X5MW)
	WATSILA – BLACKHALL	25.25
	MAKENI /MAGBURAKA	6 (3X2MW)
	PORT LOKO/LUNSAR	3 (2X1.5MW)
	KAMBIA/ROKUPR	1 (2X0.5MW)
	LUNGI	6 (2X3MW)
	KONO	6 (3X2MW)
	BO/KENEMA	15
	MOYAMBA	2 (2X1MW)
	BONTHE	1 (2X0.5MW)
	PUJEHUN	0.5 (2X0.25MW)
	KAILAHUN	0.5 (2X0.25MW)
	KABALA	0.5 (2X0.25MW)
	SIERRA RUTILE	50
	AFRICA MINERALS LIMITED	250
	LONDON MININGLIMITED	50
	ISOLATED PRIVATE DIESEL GENERATORS (AUTO-GENERATORS)	174
	BLUEFLARE	40
	SAMSHI STEEL	50
	KOIDU HOLDINGS	12
CLUFF GOLD	1.5	

	Sewa Energy Resources	45
	SUB-TOTAL MW	759.25
RENEWABLE POWER	HYDRO BUMBUNA (II,III & IV)	389
	GOMA HYDRO	12
	MAKELIE	0.12
	CHARLOTTE	2.2
	Yele	0.25
	MOYAMBA	14
	BANKASOKA	2
	BEKONGOR (I)	100
	ROKON	60
	ADDAX BIOENERGY	32
	SOLAR PV's	50
		SUB-TOTAL (MW)
WEST AFRICA POWER POOL (WAPP)		80
OTHER POWER, HYDRO, SOLAR OPPORTUNITIES		500
GRAND TOTAL (MW)		1,998.82

Source: MEWR, NPA, NRA, SPU and BKPS (2012)

Table 26: LONG TERM CONVENTIONAL THERMAL AND RENEWABLE POWER SUPPLY PROJECTION FOR SIERRA LEONE – (2020 – 2030)

POWER SUPPLY SOURCE	PLANT DESCRIPTION	INSTALL CAPACITY (MW)
CONVENTIONAL THERMAL POWER	NIIGATA – KINGTOM	10 (2X5MW)
	WATSILA – BLACKHALL	25.25
	MAKENI /MAGBURAKA	6 (3X2MW)
	PORT LOKO/LUNSAR	3 (2X1.5MW)
	KAMBIA/ROKUPR	1 (2X0.5MW)
	LUNGI	6 (2X3MW)
	KONO	6 (3X2MW)
	BO/KENEMA	25
	MOYAMBA	2 (2X1MW)
	BONTHE	1 (2X0.5MW)
	PUJEHUN	0.5 (2X0.25MW)
	KAILAHUN	0.5 (2X0.25MW)
	KABALA	0.5 (2X0.25MW)
	SIERRA RUTILE	50
	AFRICA MINERALS LIMITED	350
	LONDON MININGLIMITED	200
	ISOLATEDPRIVATE DIESEL GENERATORS	174
	BLUEFLARE	125
	SAMSHI STEEL	50
	KOIDU HOLDINGS	12
CLUFF GOLD	1.5	
Sewa Energy Resources	45	

	SUB-TOTAL MW	1092.75
RENEWABLE POWER		
	HYDRO BUMBUNA	389
	GOMA HYDRO	12
	MAKELIE	0.12
	CHARLOTTE	2.2
	Yele	0.25
	MOYAMBA	14
	BANKASOKA	2
	BEKONGOR	100
	KUSE II	91.8
	KAMBATIBO	65
	BATMAI (III & III)	150
	RIVER MANO	180
	ROKON	60
	SOLAR PV's	100
ADDAX BIOENERGY	32	
	SUB-TOTAL	2,309.12
WEST AFRICA POWER POOL (WAPP)		280
OTHER THERMAL, HYDRO, SOLAR, BIOMASS, OPPORTUNITIES		700
GRAND TOTAL POWER(MW)		3,402.62

Source: MEWR, NPA, NRA, SPU and BKPS (2012)

Section 3: Challenges and Opportunities for achieving SEFA Goals

3.1 INSTITUTIONAL AND POLICY FRAMEWORK

3.1.1 BRIEF INTRODUCTION

The Ministry for Energy and Water Resources (MEWR) is responsible for energy matters in Sierra Leone. Traditionally, the MEWR dealt mainly with issues related to electricity. But, in recent years, the Ministry's focus has been extended and other energy issues are being addressed.

Other institutions involved in the energy sector are the Ministry of Agriculture, Forestry and Food Security (MAFFS), which holds a key role in matters related to bioenergy and crop-related energy issues. Petroleum marketing and sales are handled by the Ministry of Trade and Industry (MTI) through the Petroleum Unit (PU). The Ministry of Finance and Economic Development (MoFED) also plays a supportive role in fiscal matters. In addition, the Office of the President has appointed an energy advisor, who has a coordination role and tracks implementation of cabinet decisions by the ministries.

The MEWR has produced a comprehensive Sierra Leone national energy policy¹⁴ and an accompanying national energy strategic plan¹⁵. These initiatives were adopted by the government in 2009. The main objectives of MEWR as described in the National Energy Strategic Plan are as follows:

1. to provide reliable and affordable power supplies to stimulate the economic development of Sierra Leone
2. to increase access to modern energy supplies for poverty reduction in off-grid areas
3. to improve the efficiency of energy use
4. to increase and diversify sources of energy supply in order to ensure security of supply
5. to protect the environment through the use of low-carbon and renewable fuels
6. to enhance private sector involvement in energy infrastructure development and service delivery
7. to strengthen human resources capacity and research and development in energy
8. To improve governance of the energy sector, to address in an integrated manner the key issues that will guide the effective implementation of the energy policy
9. to promote energy integration as part of the economic integration of West African States
10. to address the energy needs of women

¹⁴ Sierra Leone National Energy Policy. The republic of Sierra Leone. Ministry of Energy and Water Resources (MEWR).

¹⁵ Sierra Leone National Energy Strategic Plan. The republic of Sierra Leone. Ministry of Energy and Water Resources (MEWR).

However, implementation of the energy policy and strategic plan has been delayed due to lack of financial and personnel resources. The Ministry of Energy and Water Resources (MEWR) is understaffed and qualified staff is missing. Institutional capacity building for the Ministry and other institutions is urgently required.

An additional shortcoming is the lack of energy statistics. The national statistical office does not collect energy statistics. This task lies mainly with the MEWR, but resources and personnel for this purpose are not available. This makes it difficult to make strategic decisions on energy policy and/or evaluate the impact of programmes and policies.

In addition to the national energy policy and strategic plan, Sierra Leone produced a position paper on climate change for the COP 15 Climate Change Conference in Copenhagen 2009.¹⁶ In this position paper, the national programme of measures undertaken or planned in regard to mitigation and adaptation strategies is described. Measures in the energy, water, agriculture, forestry and food security and fisheries sector are mentioned. Specifically, the development of energy efficiency programmes with appropriate regulatory measures to reduce energy demand and CO₂ emissions has been ranked as a component of the country strategy to limit Greenhouse Gas Emissions.

As part of the national programme of measures in climate change, Sierra Leone developed a National Adaptation Programme of Action (NAPA) in 2007.¹⁷ The NAPA developed a country wide programme of priority measures to address adverse impacts of climate change. In the NAPA, energy efficiency and renewable energy were identified as part of the priority measures for the forestry sector as follows:

- Promote the use of renewable energy (solar energy) and improve energy efficiency and conservation by retrofitting existing and future structures;
- Management and protection of forests reserves and catchments areas including wetlands and reduce dependence on firewood and charcoal by using liquid fuel (LPG) and bio fuels (ethanol/methane/oils).

¹⁶ Sierra Leone Position Paper on Climate Change. COP15 Climate Change Conference Copenhagen 2009. The Republic of Sierra Leone.

¹⁷ GOVERNMENT OF SIERRA LEONE. MINISTRY OF TRANSPORT AND AVIATION. National Adaptation programme of Action (NAPA). Final Report. December, 2007

In addition, Government will undertake reforms that will ensure the operational and financial sustainability of the National Power Authority. In this regard, Government enacted the Electricity and Water Regulatory Commission Act in October 2011 that establishes a regulator for the electricity and water sub-sectors. The National Electricity Bill was also submitted to and approved by Parliament, and is presently awaiting enactment. This will facilitate the unbundling of the power sector, provide for private sector participation and establishes a basis for Power Purchase Agreements among the parties involved laying the groundwork for eventual transition to cost-reflective electricity tariffs.

Furthermore, in order to regularize the informal nature of the relationship between Bumbuna Hydro Electric Dam and the National Power Authority, Government has entered into a Power Purchase Agreement between the generator of electricity at Bumbuna and the National Power Authority (NPA), as the purchaser of electricity.

To ensure the operational and financial sustainability of the NPA in the medium-term, Government will adopt a cost-reflective electricity tariff for NPA’s operations. In the interim, Government has adopted the core principles guiding the methodology for calculating tariffs on electricity. Furthermore, to reduce technical and non-technical losses, the NPA will prepare an operational loss reduction plan, which would be implemented in 2012.

Figure 4:

2 major acts will be implemented in 2012

Electricity and water regulatory commission act 2011	National Electricity Act, 2011
<p>Functions of commission</p> <ol style="list-style-type: none"> 1. Issue, amend, revoke and cancel licenses to electricity and water operators providers 2. Set or otherwise determine rates for electricity and water services 3. Carry out regular reviews of rates and charges for regulated and unregulated services 4. Protect interest of consumers and providers of electricity and water 5. Monitor for standards of performance provision of electricity and water services 6. Conduct fair competition among competing public utilities 	<ul style="list-style-type: none"> • Act establishes the following three agencies and repeals NPA act of 1982: <ol style="list-style-type: none"> 1. Electricity generation and transmission company 2. Electricity distribution and supply authority 3. Energy asset unit • Act also makes provision for independent power producers

FIGURE 5:

The Electricity Act will set up 3 new government agencies...

<p>Electricity Generation And Transmission Company</p>	<ul style="list-style-type: none"> • Responsible for generation and transmission of electricity to the electricity distribution and supply authority • Own and operate existing generating assets of NPA, BKPS and BUMBUNA • Own and operate high voltage transmission lines • Develop, construct, own and operate new generating facilities and transmission lines • Carry on any business usually associated with electricity generation and transmission including the west African power pool
<p>Electricity distribution and supply authority</p>	<ul style="list-style-type: none"> • Responsible for supply, distribution and retail of electricity in entire country • Responsible for dispatch and system control of electricity • Secure supply of electricity at reasonable prices • Promote and encourage economic and efficient use of electricity • Purchase electricity from electricity generation and transmission company and independent power producers
<p>Energy Asset Unit</p>	<ul style="list-style-type: none"> • Responsible: <ul style="list-style-type: none"> – To ensure the transfer of assets currently held by MEWR, National Power Authority and Bo Kenema Power Services to the electricity generation and transmission company and the electricity distribution and supply authority – To manage all government electricity assets

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...and make provision for Independent Power Producers

Electricity act provision for Independent Power Producers

- **May sell electricity to the electricity distribution and supply authority**
- **Construct generating stations, including hydroelectric schemes**
- **Carry out any business usually associated with electricity generation**
- **May own, construct and operate transmission facilities as may be required for evacuation of power from generating station it owns**

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3.1.2 STRATEGIC REFORM PROCESS

- (1) Enactment of New and Amended Electricity Laws
- (2) Introduction of Independent power Producers (IPP's)
- (3) Establishment of electricity Independent Regulatory Authority
- (4) Introduction of Unbundling
- (5) Corporatization/Commercialization of State- Owned Enterprises
- (6) Tariff/Price Rationalization
- (7) Law for electricity sector Liberalization
- (8) Establishment of Wholesale electricity Market
- (9) Introduction of Independent power Distribution (IPD's)
- (10) Choice of Supplies

3.1.3 RATES OF PETROLUUM PRODUCTS AND ELECTRICITY SUPPLY

Table 27: PETROLEUM PUMP PRICES IN SIERRA LEONE: 2001 TO 2012

DATE	GASOLINE	DEISEL	KEROSINE	MFO
2/3/2001	Le 4,950.00	Le 5,050.00	Le 3,500.00	Le 2,120.00
23/5/01	5,150.00	5,050.00	3,500.00	2,120.00
4/2/2002	4,600.00	4,750.00	3,350.00	2,250.00
9/8/2002	4,900.00	4,800.00	3,500.00	2,400.00
17/2/03	6,050.00	6,000.00	4,750.00	3,305.00
17/7/03	5,900.00	5,850.00	4,600.00	3,070.00
10/11/2003	6,600.00	6,800.00	5,200.00	3,480.00
7/5/2004	7,600.00	7,420.00	6,170.00	3,340.00
1/9/2004	8,000.00	8,000.00	6,700.00	3,340.00
27/10/04	9,000.00	9,650.00	8,200.00	3,715.00
1/1/2005	8,000.00	8,650.00	7,200.00	3,515.00
31/03/05	9,500.00	9,500.00	8,500.00	4,600.04
12/8/2005	10,000.00	10,000.00	9,000.00	4,600.04
16/9/2005	11,250.00	11,250.00	10,000.00	5,689.15
16/1/2006	11,250.00	11,250.00	10,000.00	5,689.15
5/5/2006	12,150.00	12,150.00	11,000.00	5,705.33
12/5/2006	12,150.00	12,150.00	11,000.00	5,705.33
3/7/2006	13,500.00	13,500.00	13,500.00	6,000.00
19/10/06	12,950.00	12,950.00	12,950.00	6,000.00
29/10/07	12,950.00	12,950.00	12,950.00	6,000.00
20/11/07	14,500.00	14,500.00	14,500.00	7,785.00
3/12/2007	14,500.00	14,500.00	14,500.00	7,785.00
12/3/2008	14,500.00	14,500.00	14,500.00	7,785.00
2/5/2008	16,500.00	16,500.00	16,500.00	8,767.63
16/6/2008	16,500.00	16,500.00	16,500.00	9,570.09
16/8/2008	16,500.00	16,500.00	16,500.00	9,605.57
13/10/2008	15,000.00	15,000.00	15,000.00	8,418.13
27/10/2008	14,000.00	14,000.00	14,000.00	7,141.44
1/12/2008	12,500.00	12,500.00	12,500.00	5,743.59
23/3/2009	12,500.00	12,500.00	12,500.00	5,623.59
11/5/2009	12,500.00	12,500.00	12,500.00	5,623.59
4/6/2009	14,800.00	14,800.00	14,800.00	7,440.34
12/8/2009	14,800.00	14,800.00	14,800.00	8,840.38
9/9/2009	14,800.00	14,800.00	14,800.00	9,046.98

16/2/2010	15,500.00	15,500.00	15,500.00	10,029.08	
21/6/2010	16,500.00	16,500.00	16,500.00	10,393.02	
29/10/2010	17,500.00	17,500.00	17,500.00	11,473.08	
1/5/2011	5,000.00	5,000.00	5,000.00	3,545.84	Per Litre
28/5/2011	4,500.00	4,500.00	4,500.00	3,292.23	Per Litre
26/3/2012	4,500.00	4,500.00	4,500.00	3,669.73	Per Litre

TABLE 28: PRICING FORMULA REVIEW USING PLATTS AVERAGES of 13th
-24th Feb 2012

	PMS	AGO	KERO	MFO
Av.Platts (13th- 24th Feb 2012) Fob/USD per MT	1,075.48	1,010.65	1,074.35	684.03
<i>Freight /USD per Metric Ton</i>	<i>63.00</i>	<i>63.00</i>	<i>63.00</i>	<i>81.50</i>
C&F (Freetown) / USD per M T	1,138.48	1,073.65	1,137.35	765.53
Import Duty 5% C&F	56.92	53.68	56.87	38.28
Storage	4.70	4.70	4.70	4.70
Port Charges	2.00	2.00	2.00	2.00
Demurrage	2.00	2.00	0.00	2.00
Freight Levy	0.00	0.00	0.00	0.00
Other Charges (transfer & Agency Fees, etc)	5.68	4.96	5.51	3.07
Landed Cost \$/Metric Ton	1,209.78	1,140.99	1,206.43	815.58
Conversion LITRE/MT	1,362.00	1,162.24	1,248.50	1,071.44
Landed Cost \$ /LITRE	0.89	0.98	0.97	0.76
Exchange Rate Adjustment Le/USD	4,373	4,373	4,373	4,373
Landed Cost Le/LITRE	3,884.41	4,293.20	4,225.78	3,328.83
Distribution Cost Le/Litres	503.04	411.08	421.88	174.48
Petroleum Fund Le/Litres	8.25	8.25	8.25	
Excise Duty Le/Litres	137.07	7.69	0.17	0.00
Road User Charge Le/Litres	121.95	175.41		0.00
Uniform Price Adjustment Factor	70.00	70.00	70.00	
Provision for Strategic Stocks	0	0	0	
SUBSIDY REQUIREMENT Le/Litres	0.00	0.00	0.00	0.00
INDICATIVE PRICE Le/litres	4,724.72	4,965.63	4,726.08	3,503.31
CURRENT PUMP-PRICE Le/Litre	4,500.00	4,500.00	4,500.00	3,545.84
Indicative Difference	224.72	465.63	226.08	-42.53

NOTES:

1. Revised pricing formula @ Platts average for 13th- 24th February, 2012
2. **Zero Subsidy**
3. **Conversion Factor - 1 Gallon = 4.54 Litres**
4. **Average Change in Landed Cost 7.68**
5. **Excise Tax Provision is approximately Le 357 million per week.**
6. **New Exchange Rate of Le4,373.15/US\$**
7. **Automatic Pricing Mechanism:** It is currently the policy of MT&I to evoke a change when the combined effects of Platts and the Exchange Rate cause a +/-5% **change in the Leone based Landed Cost of products.**

Table 29: PRICING FORMULA REVIEW USING PLATTS AVERAGES of 5th -16th Mar. 2012

	PMS	AGO	KERO	MFO
Av.Platts (5th- 16th Mar 2012) Fob/USD per MT	1,124.00	1,020.88	1,097.45	763.08
<i>Freight /USD per Metric Ton</i>	<i>86.50</i>	<i>63.00</i>	<i>63.00</i>	<i>81.50</i>
C&F (Freetown) / USD per M T	1,210.50	1,083.88	1,160.45	844.58
Import Duty 5% C&F	0.00	0.00	0.00	0.00
Storage	4.70	4.70	4.70	4.70
Port Charges	0.50	0.50	0.50	0.50
Demurrage	2.00	2.00	0.00	2.00
Freight Levy	0.00	0.00	0.00	0.00
Other Charges (transfer & Agency Fees, etc)	5.68	4.96	5.51	3.07
Landed Cost \$/Metric Ton	1,223.38	1,096.04	1,171.16	854.85
Conversion LITRE/MT	1,362.00	1,162.24	1,248.50	1,071.44
Landed Cost \$ /LITRE	0.90	0.94	0.94	0.80
Exchange Rate Adjustment Le/USD	<u>4,381</u>	<u>4,381</u>	<u>4,381</u>	<u>4,381</u>
Landed Cost Le/LITRE	3,935.12	4,131.46	4,109.61	3,495.39
Distribution Cost Le/Litres	503.04	411.08	421.88	174.48
Petroleum Fund Le/Litres	8.25	8.25	8.25	
Excise Duty Le/Litres	0.00	0.00	0.00	0.00
Road User Charge Le/Litres	121.95	175.41		0.00
Uniform Price Adjustment Factor	70.00	70.00	70.00	
Provision for Strategic Stocks	0	0	0	
SUBSIDY REQUIREMENT Le/Litres	-138.20	-296.04	-109.58	0.00
INDICATIVE PRICE Le/litres	4,500.00	4,500.00	4,500.00	3,669.73

Table 30 Electricity Tariffs (1996-2008)

Tariff Structure	Energy Consumption (kWh)	Energy Charge (LE/kWh)					2008
		1996	1998	2000	2003	2005	
Tariff 1 Domestic							
	0-30	90	117	205	287	373	989
	31-150	110	143	293	410	533	
	Above 150	130	169	389	545	709	
	Min. Charge	2.500	3.250	6.143	8.600	11.180	
Tariff 2 Non-domestic (commercial)							
	0-30	100	130	358	501	651	1,290
	31-150	120	156	429	601	781	
	Above 150	130	169	465	651	846	
	Min. Charge	3.000	3.900	10.725	15.015	19.520	
Tariff 3 State-run institutions							
	All units	100	130	429	601	781	1,161
	Min. Charge	5.000	2.600	17.875	25.025	32.533	
Tariff 3A Others							
	All units	120	156				1,161
	Min. Charge	5.000	6.500				
Tariff 4 Industry							
	All units	150	195	517	724	941	1,376
	Min. Charge	5.000	65.000	65.000	91.000	118.300	
Tariff 5 Street lighting							
	All units	120	156	435	609	792	1,161
	Min. Charge	7.500	9.750	796	20.475	26.618	
Tariff 6 Temporary supplies							
	All units	200	260		700	910	
	Min. Charge	5.000	6.500		8.680	11.284	
Tariff 7 Welders							
	All units	200	260	546	764	993	
	Min. Charge	10.000	13.000	19.500	27.300	35.490	

Source: NPA Management (2012).

3.2 PROGRAMS AND FINANCING

3.2.1 BRIEF INTRODUCTION

The second Poverty Reduction Strategy Paper (PRSP) 2008-2012 presented a summary of the generation capacity in Sierra Leone by region in the year 2008, after the execution of the Emergency Power Programme as reported by the National Power Authority (NPA).¹⁸

The second PRSP (2008-2012) for Sierra Leone prepared by the country in consultation with national stakeholders, the World Bank and the International Monetary Fund includes providing reliable power supply to the country as one of its key four priorities.¹⁹ The PRSP states that the implementation of this key priority requires, among others:

- Improving of the management and regulation of the energy sector, strengthening revenue collection and increasing generating capacity.
- Developing new sources of power throughout the country, including the competitive sourcing of private sector investment.
- Broadening access to electricity throughout the country, for instance through mini-hydroelectric schemes.

The progress report on the PRSP 2008-2012 issued by the IMF in 2010²⁰ stated several recommendations for action in the electricity sector as follows:

- Timely disbursement of donor funds
- Proper metering and accounting for revenues
- Increased monitoring of illegal abstraction of energy, instituting energy recovery charges and penalties
- Load balancing; up-grade voltage levels to 33/11kV to reduce technical losses and accommodate increased power generation
- Gradual phasing out of obsolete equipment (causing high losses) with modern low loss equipment.

¹⁸ An Agenda for Change. Second Poverty Reduction Strategy (PRSP II) 2008-2012. The Republic of Sierra Leone, 2008.

¹⁹ An Agenda for Change. Second Poverty Reduction Strategy (PRSP II) 2008-2012. The Republic of Sierra Leone, 2008.

²⁰ Sierra Leone Poverty Reduction Strategy Paper (The Agenda for Change) Progress Report, 2008—10. IMF Country Report No 11/195. International Monetary Fund. June 2011

The primary challenges in the electricity sector are installing new generation capacity, modernizing the current transmission and distribution networks, and expanding the coverage of the networks to other regions as well as improving the reliability and quality of supply. All of these activities require substantial investments. In addition, there is a need for the sector to become financially self-supporting and more effective in recovering incurred costs. This would help improving access to long-term funding sources and facilitate expansion.

Another issue relates to the management of reactive power. Power factor correction would help reducing losses. The NPA is planning to install capacitor banks at their power substations for this purpose. In the past, there was a separate meter installed at industrial customers in order to monitor reactive power, which was billed separately. During the major electricity crisis, this practice was abolished and has not been reinstated. Currently, there is no penalty for excessive reactive power consumption by industries. Still, education about the benefits of power factor correction could be useful in order to draw the attention of industrial customers towards the technical and financial benefits. Also, financing options to support power factor correction programmes should be examined.

An Emergency Power Generation initiative was conducted between 2007 and 2008, aimed at increasing electricity generation in Freetown. This Emergency Power Programme was implemented by the Global Trading Group (GTG), an independent power producer (IPP) that re-established power at 15MW at the thermal power plant of Kingtom. The Government also entered into another agreement with Income Electrix Limited (IEL), another IPP, for an additional 25MW for generation in the eastern parts of Freetown. IEL installed a 10MW machine but due to the non-availability of fuel, only 2-4MW were able to be produced. The Emergency Power Programme led to an increase in power generation for Freetown. Still, generation capacity is well below current requirements.

There is a general lack of capacities within the country to address the energy issues contained in this policy. In order to meet the objectives of the energy sector, there is a need to ensure that concerted and sustained efforts are made at all levels to ensure a cadre of trained personnel in the energy sector. School curricula will be examined to ensure that basic information on energy is included at all levels. At the tertiary level, institutions, such as Fourah Bay College, the Njala University the Milton Margai Teachers' College and Technical Institutes should ensure that the appropriate emphasis is given to energy issues within their curricula.

Energy projects implemented by foreign entities should include the training and building of local

capacities to implement and replicate their activities. Fellowships and study tours need to be undertaken, in order to acquaint Sierra Leoneans with the latest applications and developments in the energy field around the world.

3.2.2 ON-GOING ENERGY PROGRAMMES FUNDED BY GOVERNMENT.

Tables 31 and 32 shows complete Government-funded programmes and those funded with Development Partners respectively.

Table 31: ON-GOING ENERGY PROGRAMMES FUNDED BY GOVERNMENT.

Title	Ministry	Brief Description and Time frame	Value million US\$
Lungi thermal generation	MEWR	Installation of 6MW Thermal Plant.	10.1
Koidu thermal generation	MEWR	Installation of 6MW Thermal Plant	10.1
Electrification of Makeni, Magburaka, Matotoka, Lungi	MEWR	Installation of T&D lines	12.74
Electrification of IMATT/Regent Area	MEWR	Installation of T&D line	3.89
Electrification of Koidu, Port Loko, Bamoi, kambia, Rukupr	MEWR	Installation of T&D line	9.78
Prepaid Meters for Provincial Towns	MEWR	Installation of 38,000 prepaid meters	3.6

Source: MEWR, MoFED, NPA (2012)

3.2.3 ON-GOING PROGRAMMES BY GOVERNMENT AND DEVELOPMENT PARTNERS.

Table 32: On-going Programmes by Government and Development Partners

Title	Lead Agency	Financier	Relevant SEFA Goal (s) (Access/ Efficiency/ Renewable Energy)	Brief Description and Time frame	Value
WAPP CLSG Transmission Line	MEWR	EIB , AfDB & GoSL	Access, Efficiency & Renewable	Construction of 252kv transmission line between Sierra Leone /Liberia boarder and Sierra Leone/ Guinea Boarder (2012-2015)	Euro. 104.62m
Power Systems Planning and Tariff Studies	MEWR	WB/GoSL	Access & Efficiency	9 months	US\$ 0.75m
Extension of Power & Water Project	MEWR/NPA	WB/ GoSL	Access & Efficiency	-	US\$1.4m
Upgrading western area T&D line and Commercial	MEWR/NPA	IDB/GoSL	Access & Efficiency	-	US\$11.88m
Construction of mini-hydro in Barkasoka	MEWR	UNIDO/CHINESE/ GoSL	Access	-	US\$6m
Construction of mini-hydro in Charlotte	MEWR	CHINESE/GoSL	Access	-	US\$9.77m
Construction of mini-hydro in Yele	MEWR	Lion Heart Foundation/GoSL	Access	-	US\$1.5
Construction of mini-hydro & T&D line in Moyamba	MEWR	UNIDO/CHINESE	Access & Efficiency	-	US\$65m
Solar Street Lighting	MEWR/NPA/ MoFED/ BSL	GoSL/EXIM BANK OF INDIA	Access & Renewable		US\$28.9m

Source: MEWR, MoFED, UNIDO (2012)

3.2.4 REQUIREMENT FOR ACHIEVING THE NATIONAL SEFA GOALS

Below are the proposed financial requirement projections for achieving the SEFA Goals for Sierra Leone based on current social, economic and energy factors.

Table 33: PROPOSED SUMMARY OF SEFA INVESTMENT REQUIREMENTS FOR SIERRA LEONE (2012 – 2030)

SEFA GOALS	POLICY/ million US\$	INSTITUTIONAL/milli on US\$	DELIVERIES/million US\$
ENERGY ACCESS	50	124	1,000 - (T&D) 480 - (WAPP) 1,000 - (Thermal Plants)
ENERGY EFFICIENCY	10	25	500 - (CFL, LPG, Capacitor Bank)
RENEWABLE ENERGY	90	225	4500 - (Hydro, Biomass, Solar)
Sub-total	150	374	7,480
Grand Total	7,854million US\$		

Source: MEWR (2012)

Table 34: PROPOSED DISTRIBUTION OF ESTIMATED INVESTMENT REQUIREMENTS FOR SIERRA LEONE (2012 – 2030) IN MILLION US DOLLAR

	Policy				Institutional				Deliveries			
	Short term	Medium term	Long term	Total	Short term	Medium term	Long term	total	Short term	Medium term	Long term	total
ACCESS	8	18	24	50	24	45	55	124	550	1000	930	2480
EFFICIENCY	2	3	5	10	5	8	12	25	100	180	220	500
RENEWABLE	10	35	45	90	50	75	100	225	1000	2000	1500	4500

Source: MEWR (2012)

Table 35: INVESTMENT PRIORITIES FOR SHORT, MEDIUM & LONG TERMS.

SEFA GOALS	Immediate and Short Term			2012 – 2015		
	Policy	Estimated Funds Required US\$ million	Institutional	Estimated Funds Required US\$ million	Deliverables	Estimated Funds Required US\$ million
ENERGY ACCESS	<p>*Update energy policy & strategic action plan document.</p> <p>*establish new act for distribution and commercial companies.</p> <p>*establish act to include forestry, carbon emission policy and regulation.</p> <p>*synchronize energy policy with PPP policy.</p> <p>* Power Purchase</p>	8	<p>*Strengthen the capacity of energy ministry (capacity building and infrastructure).</p> <ul style="list-style-type: none"> - Petroleum Unit - Electricity Unit - Renewable Energy Unit <p>*Set-up regulatory body.</p> <p>*Set-up Assets commission.</p> <p>*Unbundle the electricity sector (Disco. & Genco).</p> <p>*set-up asset commission.</p> <p>*set-up rural electrification scheme.</p> <p>*set-up energy co-ordination group.</p> <p>*Set-up Energy Commission.</p>	24	<p>*Increase access to electricity to 30% and access to modern energy for cooking and lighting to 20%.</p> <p>*develop and implement power and tariff studies.</p> <p>*conduct energy demand and supply survey countrywide.</p> <p>*conduct a study on the level of carbon emission in the country.</p> <p>*Increase power generation in the western area.</p> <p>*up-grade the western area T&D to reduce technical and commercial losses.</p> <p>*Improve power supply in 12 District Towns (management, Grid connection and</p>	550

Agreement with WAPP.				power generation). *conduct test and pilot studies on the sustainability of other RET in sierra leone (like palm karnel, elephant grass, rice straw, nuts etc.) *continue exploiting the use of solar lamps and PV's in public and rural communities (e.g. barefoot solar technic in sierra leone). *Grid expansion to WAPP Transmission Line. *Develop Bumbuna to produce 389MW. *Commence work on Bekongor. *Install 560MW generating capacity using all available energy options and resources.	
Sub-total US\$	8		24		550
Medium Term 2015 – 2020					
Policy	Estimated Funds Required US\$ million	Institutional	Estimated Funds Required US\$ million	Deliverables	Estimated Funds Required US\$ million
*Update policy and strategic plan. *new act on market	18	*Set-up four (4) Energy Regional Councils. * Continue the Restructuring process of	45	*Increase access to electricity to 75%.	1000

liberalization.		the energy sector.		<ul style="list-style-type: none"> *Install 100MW at Bekongor Falls. *Develop other hydro potentials. *Install solar and Biomass sources of energy. *develop and extend grid connections to WAPP line and the mining and industrial sites and towns. *grid connection within the four (4) regional towns. *Increase generation Install Capacity to 1,800MW. 	
Sub-total US\$	18		45		1000
Long Term 2020 – 2030					
Policy	Estimated Funds required	Institution	Estimated Funds required	Deliverables	Estimated Funds required
*Update Policy *Institute New Energy Acts.	24	*Continue Restructuring Process	55	<ul style="list-style-type: none"> *Increase Access to electricity to 100%. *National Grid Connection to north, south, east and western area. *Increase National Power 	930

					Generation to 3,500MW. *Increase use of modern energy sources to 65%.	
	Sub-total US\$	24		55		930
	Energy Access Total US\$ mio.	50		124		2480
Immediate and Short Term 2012 - -2015						
ENERGY EFFICIENCY	Policy	Estimated Funds Required US\$ million	Institutional	Estimated Funds Required US\$ million	Deliverables	Estimated Funds Required US\$ million
	*Policy on Duty Free concession on solar equipment and energy savings bulbs.	2	*Institute Energy Efficiency and Conservation Act *Institute Energy Efficiency Monitors	5	* Reduce Inefficiency to 30% from current level of 50%. *Replace Charcoal with LPG. *Improve on Stove efficiency. * Replace incandescent bulb with CFL Lamps Nationwide.	100
	Sub-Total US\$	2		5		100
	Medium Term 2015 – 2020					

Policy	Estimated Funds Required US\$ million	Institutional	Estimated Funds Required US\$ million	Deliverables	Estimated Funds Required US\$ million
See Activity Plan	3	See Activity Plan	8	*Reduce inefficiency to 20%. * See Activity Plan	180
Sub-Total US\$	3		8		180
Long Term			2020 – 2030		
Policy	Estimated funds required	Institutional	Estimated funds required	Deliverables	Estimated funds required
See Activity Plan	5	See Activity Plan	12	*Reduce inefficiency to 15% * See Activity Plan	220
Sub-Total US\$	5		12		220
Energy Efficiency Total US\$mio.	10		25		500
Immediate and Short Term			2012 – 2015		
Policy	Estimated Funds Required US\$ million	Institutional	Estimated Funds Required US\$ million	Deliverables	Estimated Funds Required US\$ million

RENEWABLE ENERGY	*Policy on firewood and charcoal demand through properly managed wood-fuel plantation. * See Activity Plan.	10	See Activity Plan	50	See Activity Plan	1000
	Sub-total US\$					
Medium Term 2015 – 2020						
	Policy	Estimated funds required	Institutional	Estimated funds required	Deliverables	Estimated funds required
	See Activity Plan	35	See Activity Plan	75	See Activity Plan	2000
	Sub-total US\$	35		75		2000
Long Term 2020 – 2030						
	Policy	Estimated Funds Required US\$ million	Institutional	Estimated Funds Required US\$ million	Deliverables	Estimated Funds Required US\$ million
	See Activity Plan	45	See Activity Plan	100	See Activity Plan	1500
	Sub-total US\$	45		100		1500

	Renewable Energy Total US\$ million.	90		225		4500
	TOTAL US\$	150		374		7,480
GRAND	TOTAL US\$ million	7,854				

Source: MEWR, SPU, MoFED, NPA and MAFFS (2012)

3.3 PRIVATE INVESTMENT AND ENABLING BUSINESS ENVIRONMENT

During a recent roundtable Strategic Planning Unit (SPU) conference on infrastructure and energy on 14th May, 2012, some major private companies especially those in the mining and energy sector participated fully by making presentations of their companies activity in the country. Below are the names of some major private companies who have shown interest in the energy sector:

- LONDON MINING
- AFRICAN MINERALS
- JOULE AFRICA
- SIERRA RUTILE
- ADDAX
- SAMSHI STEEL
- BLUEFLARE
- FIRST STEP ECONOMIC OPPORTUNITY ZONE
- SMOLPAWA
- SUNTROUGH
- US POWER & ENVIRONMENT (USP&E)

The relevant power needs of these companies have been captured in the total power installed capacity for the short, medium and long term planning period.

3.4 GAPS AND BARRIERS

3.4.1 GAPS:

The solutions to the challenges facing the energy sector could be highlighted as follows:

- (a) Ensuring adequate, reliable, affordable and cost effective power supply within the country;
- (b) Improving energy efficiency and conservation in all sub-sectors
- (c) Improving accessibility to electricity supply, particularly in the rural areas;
- (d) Providing adequate energy for socio-economic activities as included in various policy documents: PRSP, Vision 2025, the Millennium Development Goals (MDGs) and SEFA.
- (e) Putting in place effective institutional framework to ensure the smooth supply of energy, including coordination, monitoring and evaluation, supervision and control;
- (f) Attracting private investors to the energy sector;
- (g) Ensuring continuity of supply in case of emergencies;
- (h) Selection of appropriate technology options for the energy sector;
- (i) Meeting the energy requirements of women.

The current deforestation high rate due to harvesting of traditional fuels, can lead to environmental, health and social impacts on the 65 % of the population living in rural areas.

3.4.2 OPPORTUNITIES

The opportunity exists now, more than ever before, to address energy issues.

First and foremost, the political will is present at the highest level of Government, in recognition of the importance of energy for the achievement of the development goals.

In addition, as a country recovering from conflict, there is a general acknowledgement by all stakeholders, including development partners, that great strides need to be taken to get the country

back on track and this involves restoring and increasing energy capacity including taking steps to implement the Power Sector Master Plan, which was drawn up in 1996, and which revealed vast hydropower potential, which could not at the time be pursued as a result of the war.

Furthermore, the recognition of the international community of the climate change phenomenon has led to greater attention being paid to issues relating to cleaner energy development and could lead to additional resources to support energy programmes.

Finally, developments in the West African Sub-region provide an opportunity for Sierra Leone to benefit from energy resources within the sub-region, such as provided by the West African Power Pool and the West African Gas pipeline.

3.4.3 RECOMMENDATIONS

Recommendations for potential interventions in developing the Energy Sector in Sierra Leone:

1. There is a need for a comprehensive approach to address cooking and other heat applications in the households sector. Such an approach should contemplate a combination of different energy carriers and technologies, balancing the strengths and weaknesses of alternative cooking fuels (firewood, charcoal, LPG), addressing the whole value chain and tailoring them to the specific conditions of the target communities.
2. Another area of potential intervention in the households sector is lighting. Lighting in urban areas is made mainly with electricity and kerosene/gas lamps. In rural areas, mostly kerosene lamps are used. CFL programmes could help to reduce the peak electricity load in the urban residential sector, thus providing some relief regarding the installation of new generation and transmission capacity. Such programmes could also help to reduce the costs that residential and commercial customers pay for running diesel generators. On the other hand, alternatives to kerosene lamps are required. In non-connected areas, solar energy could provide an alternative, but sound business models are required.
3. There is a need for improving the efficiency of the obsolete transmission and distribution networks.
4. Awareness rising about the benefits of power factor correction could be useful in order to draw the attention of industrial customers towards the technical and financial benefits. Also, financing options to support power factor correction programmes should be examined.

5. Generally, there is a need to raise awareness of energy efficiency among the general population. People do not seem to be aware that their energy consumption patterns are inefficient or that superior alternatives could be available.
6. There are numerous opportunities for the use of solar energy (e.g. solar photovoltaic, solar water heating, solar lanterns, solar refrigerators, solar cooking and solar water pumps). A number of actions are required in order to pursue this option. Specifically, it is necessary to promote the creation of markets for solar technologies through private actors. This requires, among other things, sound business models and qualification of technical staff.
7. There is need to embark on tapping the hydro potential of the country vigorously.
8. There is also potential for modern and more sustainable forms of bioenergy in Sierra Leone. Agricultural residues are abundant and if tapped, they could provide a significant source of energy. Specifically, cassava appears to be a promising feedstock for energy uses. The waste water, peelings and solid residues from cassava processing could, for instance, be used as a potential source of feedstock for biogas production, which has not been explored as an option yet. Initiatives focusing on the cassava value chain may prove beneficial as an income-generation activity for rural communities.
9. In addition, the potential use of biofuels such as biodiesel from palm oil or ethanol for domestic consumption in Sierra Leone could be explored.
10. There is an urgent need to train energy professionals at different levels, from those that conceive and manage programmes and projects in public institutions to technical staff working with technologies in the field. Only with capacity building at different levels, would it be possible to overcome the substantial hurdles for energy development in Sierra Leone. Specifically, there is an urgent need to set up local training programmes for technicians in renewable energy and energy efficiency, in order to have access to a qualified work force that is capable of installing, maintaining and repairing equipment.
11. There is a need to conduct additional pilot programmes supporting the introduction of Multi-functional Platforms (MFP) in rural areas and targeting e.g. cooperatives and women organisations. The possibility of using biofuels to run MFP should be explored.

3.5 ENERGY ROUNDTABLE INITIATIVES BY GOVERNMENT AND PARTNERS.

The Energy Roundtable Special Committee on Energy issues made the following recommendations on 18th and 30th May, 2012 by the MEWR and SPU at 5th Floor, Electricity House.

The special committee was comprised of MEWR, SPU and interested partners in the Energy Sector.

3.5.1 RECOMMENDATIONS

- Set-up Short term requirements for power for the Mining Industry. Need to work out modalities so that private sector can be partners
- Combine all needs for presentations and compare it with Ministers forecast to get a clear picture of what is needed nationwide
- Design a system that will provide energy needs by bulk customers and take into account transmission losses, small consumers, transmission and distribution systems to meet the demand
- Conduct a structures demand study
- MEWR to follow-up the Power sector integrated study & tariff study by the World Bank – contracting in a month, 9 month for study. However, a tariff study had been conducted in the past five years
- Prepare a national energy demand for prospective investors.
- Sustainable Energy for all – EU can give support to develop a national demand plan.
- Need to know how mining companies are planning to meet demand.
- Require a planning unit to be constantly updating the demand given changes in the economic environment
- Need to set up a legal and regulatory framework for the energy sector
- Regulator should be in place to set tariffs and regulate the sector (Immediate)
- NPA should be allowed to charge economic tariff so that they can recover their costs.
- Challenge with the Legislation – the generation aspect was legislated but not the distribution aspect. The current policies should be implemented. need capacity in MEWR to handle energy issues (Immediate)
- The Government wants to implement the reforms; we need to work with Donor partners for support. SPU will drive this with the Minister and the MEWR will work on a work plan with costs.
- MEWR's Response: The legislation has been passed. He suggests that this working group review the legislation and make their recommendations.
- MEWR anticipates a visit from a delegation from SEFA (7th & 8th June 2012). UNDP has contracted Dr. Patrick Tarawalli (Energy Consultant) to conduct a needs analysis in readiness of the SEFA project. The analysis of the gaps in the electricity demand, would lead to the development of a country strategic plan of action. This would incorporate the unbundling of the sector.

- The group emphasised the need for establishing a regulator, and the unbundling of NPA should be implemented as soon as possible. They acknowledged that this topic had been discussed for the past seven years and nothing has been done. Until Now?

The Ministry should not plan to set everything in place/ solve all the issues before putting the Regulator in place. The MEWR will make the policies and have the regulator implement.

MEWR: what principle step does the group think should be put in place for setting up the Regulatory Commission? Take into consideration that the Donor are voicing for the unbundling of the sector, but are not dedicating funds for the process and NPA has grown beyond what it was formerly known?

Group Response: MEWR should develop a plan, as Government, for the unbundling and establishment of the Regulatory Commission, which would make the discussion with Private sector companies transparent.

MEWR: Dr. Tarawalli should include the need for a Regulatory Commission in his gap analysis and include a budget, which would be presented to the SEFA team as a priority.

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ANNEX 1

**Report on the Sustainable Energy for All (SEFA) mission to Sierra Leone
7th and 8th June, 2012**

The SEFA Delegation commenced their visits on the 7th and 8th June, 2012. Ambassador/ Head of EU Delegation to Sierra Leone (Mr. Jean-Pierre REYMONDET-COMMOY) introduced the delegation to the Ministers of Finance and Economic Development (Dr. Samura Kamara), Agriculture Forestry and Food Security (Dr. Joseph Sam Sesay) and Energy & Water Resources (Mr. Oluniyi Robbin-Coker). Mr. Reymondet-Commy indicated that the SEFA Delegation to Sierra Leone was influenced by a follow-up action in connection with the UN Secretary-General's recognition and selection of Sierra Leone as a potential first-mover of the SEFA initiative, which has been conceived to ensure universal access of modern energy by 2030, double energy efficiency, and double the use of renewable energy sources in the global power mix.

After the introduction of the Delegation, the Head of the EU and UN Delegation Mr. Jean-Paul JOULIA formally introduced the team and explained the objective of the SEFA initiative to the Ministers. He briefed the ministers on the UN Secretary-General's call to join the initiative and enquired whether Sierra Leone is prepared and committed to the SEFA initiative.

Furthermore, he emphasized that the initiative will require significant human and financial resources. Accomplishing the goals of the initiative would also depend on attracting the private sector and involving development partners. Mr. Joulia mentioned that the SEFA goals are challenging and how we can translate them into real action. The gap analysis of the energy sector will be essential to determining the current energy situation in Sierra Leone and opportunity to improve access, efficiency and the use of renewable energy sources.

In response, the ministers unanimously thanked the delegates and said that the UN Secretary-General's SEFA initiative is aligned and consistent with His Excellency the President Dr. Ernest Bai Koroma's Agenda for Prosperity. The Ministers also assured the delegation that the Government of Sierra Leone has accepted the call to ensure that SEFA by 2030 is a reality in Sierra Leone. They also emphasized that energy is a trigger for economic growth and that the SEFA goals would be consistent with wealth creation in the country. The ministers underscored the point that the institutional regime of the energy sector is undergoing restructuring to meet the demand of the new SEFA initiative and the Government's Agenda for Prosperity. The ministers informed the delegation that, Sierra Leone has great potential in renewable energy from sources such as hydro, solar and biofuel. The ministers spoke of various initiatives being undertaken by their ministries to improve access to energy. Most notably, the ministers referred to the solar light barefoot college

project, the Agriculture Business Center (ABC) project, West Africa Power Pool (WAPP) project and several other electrification projects intended to improve community access to modern energy. However, the ministers explained the challenges their ministries are faced with such as deforestation, inefficient use of woodfuel, high power system losses, unstructured tariff, low level of access to electricity and low access to renewable energy. The ministers explained that they have planned to minimize the negative effects of these challenges by providing a prioritized investment estimated at US\$7.8 billion within a period of 18 years. It was agreed that, a systematic approach will be carried out to properly analyze, interpret and validate the activity plan and cost needed to fix the gaps.

The ministers and SEFA delegation resolved that the key driver of change in the energy sector is the private sector, which must be encouraged to bring investment into the sector. Also, the private sector should be supported by financial institutions subject to realistic Government policies and regulations. Furthermore, the SEFA Organizers' and Government of Sierra Leone should be in a position to identify key actors to finance the SEFA programmes in Sierra Leone.

The ministers indicated that Government is encouraging the use of renewable energy sources like solar and hydro more than the conventional thermal power sources to achieve clean energy and reduce the level of carbon emissions in the country.

The Ag. Director General (Mr. Rahmond Kargbo) of the Petroleum Directorate gave a brief status report to the SEFA delegation on the petroleum exploration situation and that the operational preparations that are currently in progress.

The Administrator of the Environmental Protection Agency (EPA), Mrs. Habbijatou Jallow expressed her concern regarding the environmental effect caused by woodfuel and the effects of such fuel sources on the health and social life of people. Communities are now beginning to look for alternative forms of modern energy especially for cooking.

The issue of Gender in relation to energy use was discussed. It was noted by Ms. Naasu Fofana that women are the most vulnerable group and are exposed to disadvantaged circumstances relative to male counterparts. Concerns were raised by the gender expert as to how women can contribute to SEFA. It was resolved that women should be given quality education so that they can be empowered to use modern energy more effectively.

NGO's and civil society contributed to the debate and outlined some energy-related programmes geared to improving the standard of living in rural communities. The Donors also outlined some of the challenges facing the energy sector in Sierra Leone and their various contributions to the sector. Attendees in this session pledged their continued support and expressed that the country's investment is huge and that the private sector has a role to play.

In general, the SEFA delegation responded to the meetings by saying that they are impressed with what they saw and that Sierra Leone can be used as an example of preparedness to embrace the SEFA initiative from which other countries could learn. Furthermore, members of the delegation indicated that, given clarity on the gaps, and they could be in position to support capacity building, testing and pilot schemes to move toward the SEFA Goals. It was resolved that the Ministry of Energy and Water Resources Energy Division should take the lead and coordinate all energy issues with other ministries and that two additional staff will be tasked to especially work on the SEFA initiative.

The UNDP representative and the ministers expressed their appreciation to the energy consultant for developing the energy profile of Sierra Leone and making it ready for the SEFA delegation which they found to be useful during their mission.

The following development partners and Stakeholders were in attendance; World Bank, International Monetary Fund, United Nations Development Programmes, Food Agriculture Organization, DfID, AfDB, Chinese Embassy, JICA, MRU, Private Sector, Civil Society, Media Representative and other stakeholders.

The next step is for the Government to write to UN Secretary- General and SEFA Organizers' accepting the call to join the initiative; Government should make known its plan to the International Community. After RIO+20, Donors will work together to take action.