



United Nations Development Programme
Country: Sierra Leone
PROJECT DOCUMENT



Brief Project Description

The production and trade in charcoal has been a massive rural growth industry over the past decade in Sierra Leone. A minority urban fuel during the 1980s and 1990s, it has gradually displaced firewood and is now the fuelwood of choice for the majority of urban residents because: it is affordable by all cadres of society and the only option available for the many low waged urban employees; it is substantially more efficient than wood and burns with very limited smoke and less fire hazard (preferred by landlords) and it has higher calorific value and easier to transport than wood. As a result, many people consider charcoal a relatively modern fuel when burn on the modern stoves. Notwithstanding its popularity, the charcoal and cookstoves sub-sector remains informal, unregulated and fragmented, plagued by inefficient production system relying on non-renewable sources supported by incoherent and often conflicting policy statements.

Harvesting of wood for charcoal differs considerably to firewood as charcoal wood supplies are often obtained from forests and woodlands rather than farms. This is because in many of the higher production level villages, charcoal production conducted in addition to farming, instead of farming; as the trade has become lucrative enough for some villages that they have been able to give up their reliance on agriculture and purchase all household supplies from charcoal production income. At this rate, the pressure on natural resources will be exacerbated even further as communities produce more charcoal to meet their livelihood demands and urban charcoal consumer demand. It is worth noting, however, that one immediately evident issue is that some charcoal producers specifically target hardwood species of high commercial export value, resulting in an economically inefficient use of forest resources. Interventions should avoid trying to fundamentally change how the fuelwood industry operates but instead solutions should be focused on making the trade and business more efficient, resilient and sustainable by incentivizing all value chain actors as inclusive business.

Objectives of the Project: The overall goal of this project is ***“Energy Efficient Production and Utilization of Charcoal through Innovative Technologies and Private Sector Involvement in Sierra Leone.”*** The objective of the project is to bring economic, social and environmental benefits through the production of certified charcoal from sustainably sourced feedstock and through the promotion of improved cookstoves to reduce fuel wood demand, improve health and reduce greenhouse gas emissions. The project is well aligned with: i) the Agenda for Prosperity (2013-2017) to promote a low carbon, climate resilient, high growth, genders sensitive, inclusive and sustainable development path; and ii) the National Forestry Policy (2010) to promote the rehabilitation and conservation of forests, soil and water resources, and other relevant national policy and legal framework.

Overcoming Barriers: This project seeks to overcome the regulatory, institutional, technical, financial and social barriers for the scaling up of 1,000 efficient and certified charcoal kilns and 15,000 certified improved cookstove across Sierra Leone by:

1. Creating enabling environment to attract private sector investment through demand side management by improving the coordination, monitoring, verification and enforcement of Standards, Certification and Label scheme for market transformation to energy efficient cooking products and services.
2. Developing certified social entrepreneurs equipped with technical and business skills to champion the production, distribution and marketing of certified improved cookstoves and sustainably sourced and certified charcoal as inclusive business with access to: value chain financing (start up grant, rebate and loan guarantee, carbon finance); and incentivizing women groups and using marketing information and participatory technology development approach to create demand that meet local needs in order to reduce supply risks.
3. Strengthening the technical capacity and business resilience of value chain actors through gender sensitive, user friendly and evidence-based knowledge products (DVD, radio, manual) and peer-to-peer participatory training.

Management of Project: UNDP: Implemented under the Global Environmental Facility Phase 5, System of Transparent Allocation of Resources (GEF-5 STAR)

Project Title: Energy Efficient Production and Utilization of Charcoal through Innovative Technologies and Private Sector Involvement in Sierra Leone

UNDAF Outcome(s): By 2018, targeted Government institutions, the private sector, and local communities manage natural resources in a more equitable and sustainable way.

UNDP Strategic Plan Environment and Sustainable Development Primary Outcome: Expanding access to environmental and energy services for the poor

UNDP Strategic Plan Secondary Outcome: Strengthened national capacities to mainstream environment and energy concerns into national development plans and implementation systems; and Countries develop and use market mechanisms to support environmental management

Expected CP Outcome(s): 3. Access to sustainable energy and livelihoods for remote Chiefdoms (sub-districts/blocks) improved

Expected CPAP Output (s):

3.1: Adequate policies on renewable energy in place, strong institutional linkages established, and knowledge, awareness and capacities of stakeholders improved (policy makers, financiers, suppliers and end-users);

3.2: Effective and affordable renewable/alternative energy technologies for remote Chiefdoms supported through demonstration projects and private sector participation.

Executing Entity/Implementing Partner:

United Nations Development Programme

<p>Programme Period: 2014 – 2019</p> <p>Award ID: 00081156</p> <p>Project ID:00090575</p> <p>PIMS #: 4904</p> <p>Start date: March 2015</p> <p>End Date: Dec 2019</p> <p>Management Arrangements: DIM</p> <p>PAC Meeting Date: February 10, 2015</p>	<table> <tr> <td><i>Total resources required (total project fund)</i></td> <td style="text-align: right;">\$10,589,670</td> </tr> <tr> <td>- Regular (UNDP TRAC)</td> <td style="text-align: right;">\$200,000</td> </tr> <tr> <td>- GEF</td> <td style="text-align: right;">\$1,768,182</td> </tr> <tr> <td>Other (partner managed sources)</td> <td></td> </tr> <tr> <td>- SLEPA-EU CC Cap Dev</td> <td style="text-align: right;">\$5,016,000</td> </tr> <tr> <td>- ICRAF BioDev</td> <td style="text-align: right;">\$823,314</td> </tr> <tr> <td>- GERES (NGO)</td> <td style="text-align: right;">\$50,000</td> </tr> <tr> <td>(In-kind)</td> <td></td> </tr> <tr> <td>- Government</td> <td style="text-align: right;">\$500,000</td> </tr> <tr> <td>- BRAC (Microfinance company)</td> <td style="text-align: right;">\$1,682,174</td> </tr> <tr> <td>- WestWind Energy (Private sector)</td> <td style="text-align: right;">\$200,000</td> </tr> <tr> <td>- Toyola Energy (Private sector)</td> <td style="text-align: right;">\$100,000</td> </tr> <tr> <td>- Bockarie (Private sector)</td> <td style="text-align: right;">\$150,000</td> </tr> <tr> <td>- Samu Enterprise (Private sector)</td> <td style="text-align: right;">\$100,000</td> </tr> </table>	<i>Total resources required (total project fund)</i>	\$10,589,670	- Regular (UNDP TRAC)	\$200,000	- GEF	\$1,768,182	Other (partner managed sources)		- SLEPA-EU CC Cap Dev	\$5,016,000	- ICRAF BioDev	\$823,314	- GERES (NGO)	\$50,000	(In-kind)		- Government	\$500,000	- BRAC (Microfinance company)	\$1,682,174	- WestWind Energy (Private sector)	\$200,000	- Toyola Energy (Private sector)	\$100,000	- Bockarie (Private sector)	\$150,000	- Samu Enterprise (Private sector)	\$100,000
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Agreed by (Government): _____

Date/Month/Year

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1. SITUATION ANALYSIS

1.1 Introduction to Sierra Leone

In 2002, Sierra Leone emerged after more than 10 years of civil war, preceded by a long period of unstable and non-transparent governance under a so-called 'shadow state', influenced strongly by personal interests that caused a near break-down of the existing governance structures (see Reno, 1995 and Richards, 1996). This had profound impacts on the society and economy. For example, in 2012, Sierra Leone was listed 177 out of 187 on the Human Development Index, and about 80% of the population lived below the poverty line of USD 2 a-day (UNDP, 2012; World Bank, 2011). Consolidating peace and developing the national economy has been a key priority for the country (UNDP, 2012). For the last 5 years average growth has been between 3-8% per year (6% in 2011) and in 2011 the Gross Domestic Product (GDP) was USD 2.97 billion.



Figure 1: Map of Sierra Leone with administrative boundaries

Sierra Leone is a parliamentary republic, operating under two types of governance systems that fall into different geographical areas of the country. The Western Area and the capital Freetown (former British colony) operate under general law, comprising a system of pre-independence English common law and post-independence statutory law (Conway and O'Sullivan 2011). Meanwhile the Provinces, to the North, East and South, (former British protectorate) operate under a dual system of general law and customary law, of which the latter is the most dominant. Customary laws vary between chiefdoms. They are mostly unwritten but nevertheless enforceable as they are recognized

in national legal frameworks. However, if there is inconsistency between the two, customary law can be overruled by statutory law.

1.2 Rationale for Intervention

The challenge for Sierra Leone is to pursue economic development without creating additional burdens on natural resources thereby preserving ecosystems that are critical to maintaining the quality of life and providing environmental services to society. Sierra Leone is a relatively small country (7.16 million ha) situated along the Atlantic coast of West Africa between the Republic of Guinea to the north and east and the Republic of Liberia to the south and east. It occupies the western edge of the Upper Guinean Forest ecosystem and is endowed with rich natural resources including minerals and oil as well as high biodiversity. Sierra Leone's rainforests, mangroves and savannah forests host a high level of endemic and (internationally) rare and threatened species. The Upper Guinean Forest ecosystem is listed on the World Wildlife Fund's (WWF) "Global 200" list of critical regions for conservation and is included as one of Conservation International's 34 global biodiversity hotspots (Brown and Crawford, 2012). Although once a much forested country (about 70%) the majority of the original forest cover has now been converted to agricultural lands and savannah and only 5% of the original intact forest remains (GoSL, 2010). These remaining parts of forestlands are classified into 7 vegetation types: moist rainforest, semi-deciduous-, montane-, savannah-, and mangrove-forest and farm bush and swamp.

Total forest cover is estimated at 2,725,821 ha; approximately 38% of the total land area (FAO, 2010). Between 1990 and 2010 annual average deforestation rates were 20,000 ha per year. In 2010 this represented an annual deforestation rate of 0.70% (of the total forest cover) (FAO, 2010). The main direct driver of deforestation is agriculture, such as shifting cultivation practices, but also large scale agricultural investments that are increasingly taking up large tracts of arable and forestland. Other important drivers are logging (both legal and illegal), mining, and unregulated use of wood for construction and fuel wood e.g. charcoal production (GoSL, 2010).

Natural resources play a pivotal role in the lives of people in the Sierra Leone with 75% of the population living in rural areas and over 70% employed by the agriculture and forestry sector. Increasing economic development and demographic pressure are changing agricultural and forestry systems in the Sierra Leone and creating ever-increasing pressure on the natural resource base. GoSL seeks to promote a paradigm shift towards low-emission and climate-resilient development pathways, to achieve economic efficiency in directly securing emission reductions at cost, and to support equity in the distribution of resources.

Internal migration to urban areas (specifically the capital Freetown), poor enforcement of legislation and widespread poverty are some of the main contributing factors to fuel poverty and degraded natural resources. These trends are rapidly heading towards a state where over-extraction and insufficient re-planting of trees is threatening both people's ability to afford fuel wood for cooking and their ability to easily attain it in other ways. Coupled with this humanitarian issue, the deforestation and forest degradation that occur as a symptom of people's reliance on wood fuel (+90% of the population) is threatening the sustainability of the natural environment and its ability to perform ecological services in and around Freetown.

The impact of natural resources degradation (forest, habitat, land, water, soil and biodiversity), their causes and underlying root causes are summarised in Table 1.

Main causes of forest and land degradation in Sierra Leone are:

Deforestation: Harvesting of the country's most valuable tree species, notably sandalwood, ebony and redwood; intensive cutting of trees for firewood; Intensive cutting of forest and mangrove¹ trees

¹ <http://www.voanews.com/content/sierra-leones-fragile-mangrove-forests-under-threat-86271842/161525.html>

for charcoal production leading to loss of estuarine marine life and their destructive impacts the entire marine food chain; lack of access to alternative and affordable clean technology.

Inappropriate agricultural practices: Primarily a problem in dry land farming where vegetables are grown on steep slopes without any soil conservation measures; shifting cultivation; slash & burn techniques; in upland areas.

Forest fires: Recurring wildfires on grass-covered mountain slopes; many fires are deliberately lit to stimulate grass growth for grazing as well as to aid in hunting.

Over-grazing: Grazing animals, especially goats, roam freely through public “rangelands”, rather than being “stall fed” on collected fodder; Introduction and spread of invasive weed species; Destruction of vegetation, compaction of soils, loss of soil moisture and organic matter, soil erosion from wind and water run-off.

Demographic pressures: With increasing population pressure and lack of alternative opportunity, forest encroachment for forest products become the only source of rural income.

To address the above problem, the Energy Efficient Production and Utilization of Charcoal (EEPUC) Project with the support of the Global Environment Facility (GEF), the Government of Sierra Leone (GoSL), the United Nations Development Programme (UNDP) and other funding partners is proposed. Overall, the Project is expected to result in a reduction of annual fuel wood consumption, improved energy access, create green employment and reduce GHG emissions in Sierra Leone through demand side management to scale up certified cookstove and certified charcoal business as a stop gap solution to accessing modern energy services (electricity, LPG, ethanol).

Impact of Forest and Land degradation	Causes of Forest and Land Degradation	Underlying causes
Forest and watershed degradation	Deforestation and illegal logging of important tree species	Poverty
Soil degradation and Sedimentation of waterways	Firewood collection including fragile mangrove species	Demographic pressures
Weed invasion	Uncontrolled grazing	Ineffective law enforcement
Increased water shortages – spend longer time in collection	Forest fire and slash and burn activities	Lack of access to alternative biofuel and bioenergy solutions
High emissions of GHG	Shifting cultivation	

Table 1: Impact and underlying causes of forest and land degradation in Sierra Leone.

The implementation of the Project is expected to bring about the following benefits to the country and to rural communities:

i. Economic benefits:

- Energy, fuel wood and expenditure savings through certified, standards and labelled energy efficient appliances and production system
- Access for people living in rural areas in Sierra Leone to alternative less polluting and efficiently produced energy

- Increase in investments in greening up the energy value chain (cottage industry, food processing) facilitated by an established Centre of Excellence equipped with local champions and social entrepreneurs
- Empowered local MFIs for developing competitive energy loan products and services

ii. Environmental benefits:

- GHG emission reductions through energy efficient and renewable biomass usage
- In partnership with ICRAF, establishment/supplementing of Farmer Managed Agroforestry to provide a sustainable supply of fuel wood to villagers and peri urban end users and to improve carbon stocks and environmental services
- Reduced deforestation with benefits for improved biodiversity and ecosystem services

iii. Social benefits:

- Employment generation at the community level through the empowerment of women and youth as social entrepreneurs equipped with technical, financial and business skills to participate as value chain actors through inclusive business and start up grant
- Productive uses of energy and business resilience to changing climate
- Reduction of health hazards and health bill and reduce sick days
- Time savings, in particular, for women and children from collection of fuel wood, leading to more productive use of their time and contribute to MDG goals.

1.3 Energy Situation in Sierra Leone

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 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 National Energy Policy (2009) aims to provide affordable, sustainable, and secure energy to all Sierra Leoneans. Additional goals include increasing economic stability and developing rural and urban areas using energy as a tool for growth. Utilizing indigenous resources, reducing reliance on imported fuels, environmental conservation and sustainable resource management are other key focus areas of this policy.

I. Energy Supply situation

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. Table 2 represents the Energy that Households, Industry, Service, Agriculture and Forestry, Fishing, and the Transport Sector used from Electricity, Fuel and Renewable (such as Hydro, Wood fuel).

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	166.0	3.1	1,344.2
2008	1,197	192.4	12.8	1,402.2
2009	1,218	164.5	12.3	1,394.8
2010	1,241	199.3	16.2	1,456.5
2011	1,262	187.8	16.1	1,464.9

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

II. Energy demand situation

Biomass energy comprises at least 85% of all energy used in the country.² It provides the bulk of the energy supplied in both the household and the commercial and service sectors of the economy³. The structure of the energy supply and demand in Sierra Leone by sectors and energy carriers as reported by the National Energy Policy and Strategic Plan (2009) is presented in the Table 3. 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 fire wood consumption takes place in the household sector, mainly for cooking in rural areas (Table 4). Charcoal is also consumed in the residential sector, mainly for cooking purposes in urban areas. Still, there is some consumption of fire wood and charcoal in the industrial sector as well as electricity, LPG and kerosene.

Sector	Biomass		Petroleum Products	Electricity (Grid Connected) (Thermal, Hydro)	Total %
	Firewood	Charcoal			
Agriculture, Forestry, Fishing	1%	-	5%	2%	2%
Mining	-	-	9%	1%	2%
Industry/Commercial	3%	10%	12%	60%	21%
Transport	-	-	49%	-	12%
Household/Residents	96%	90%	25%	37%	63%
Total	100%	100%	100%	100%	100%

² MEWR. 2009a. "2009 National Energy Plan", September 2009; UNDP. 2012. "National Energy Profile of Sierra Leone", June, 2012. GoSL. 2012. The Agenda for Prosperity: Road to Middle Income Status - Sierra Leone's Third Generation Poverty Reduction Strategy Paper (2013 – 2018).

³ MEWR. 2009b. "National Energy Policy and Strategic Plan: Energy for Poverty Alleviation and Socio-Economic Development: Part II Energy Strategy Plan", September 2009

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

Table 4: Household energy consumption in Sierra Leone (National Directorate of Statistics, 2012)							
District	Total Population	Area (Sq. km)	Population Density	Number of households	Annual Fuel wood consumption (t/yr)*	TOE	tCO ₂ -eq/yr
Sierra Leone	6,037,660	71,500	83.3	1,006,475	3,122,589	3,393,825	4,660,056
Bo	624,389	5,249	118.9	103,859	322,223	350,212	480,875
Moyamba	262,725	6,922	37.9	50,607	157,008	170,646	234,314
Pujehun	320,686	4,135	77.5	45,797	142,085	154,427	212,044
Bonthe	160,114	3,528	45.4	29,812	92,492	100,526	138,032
Kenema	621,750	6,093	102.0	112,027	347,564	377,754	518,694
Kono	305,952	5,681	53.9	54,676	169,632	184,367	253,154
Kailahun	442,454	3,899	113.5	81,445	252,683	274,632	377,097
Bombali	469,064	7,985	58.7	72,640	225,366	244,941	336,329
Port Loko	529,831	5,719	92.6	76,787	238,232	258,925	355,530
Kambia	324,769	3,108	104.5	45,489	141,130	153,389	210,618
Tonkolili	413,273	7,003	59.0	62,617	194,269	211,144	289,921
Koinadugu	318,849	11,621	27.4	53,270	165,270	179,626	246,644
Western Area	1,243,804	557	2233.0	217,449	674,636	733,236	1,006,805

* Based on 85% fuelwood used for cooking and 10 kg fuelwood per day.

The biomass energy situation has transformed dramatically over the past decade. Since the end of the civil war there has been a significant increase in charcoal production nationally and in charcoal consumption in urban areas – most notably in Freetown. The vast majority of production now occurs in the provinces.⁴ A number of villagers have given up farming to become full-time charcoal and commercial fuel wood (firewood) producers, illustrating the new vitality of the trade and its importance for rural livelihoods.”⁵

As Table 5 shows, Freetown biomass energy consumption, until recently, was primarily firewood (50.7% in 2004). Today, roughly one quarter (26%) of households use firewood as their primary cooking and heating fuel in Freetown, while charcoal constitutes almost three quarters.⁶ However, wood remains the major source of cooking energy in other urban areas (SLIHS, 2003, SLIHS, 2011), which has important implications for household cooking efficiency improvement options. Wood fuel and charcoal currently account for over 98% of all household cooking energy in Sierra Leone (SLIHS, 2011).

⁴ Primarily in Western Region, with limited amounts still produced on the Peninsula and in Western Rural. Project Rapid Rural Appraisal and, Schultz, M. 2011. Land and Forest-Cover Change Analysis, Western Area Peninsula Forest Reserve (WAPFR), Sierra Leone. 2nd Report of Activities. OBF 2011.

⁵ Munro, Paul & Greg van der Horst. 2012b, The Domestic Trade in Timber and Fuel wood: Products in Sierra Leone: Current Dynamics and Issues. FAO, EFO/FLEGT, Freetown, 2012.

⁶ Note the SLIHS of 2003 and 2011 did not measure actual quantities of household energy consumed. They simply asked for “primary energy source for cooking”. However, interviews with all three major petroleum product distribution companies (National Petroleum, Total, Afrigas), showed kerosene imports were down to a fraction of 2004 levels, while only Afrigas is trying to expand LPG sales. While statistics on quantify of electricity used for cooking by households are not available, NPA (National Power Authority), MoE and consumer interviews indicate that very little electricity is used for cooking and water heating.

Table 5: Freetown Population & Primary Cooking Energy, 1963 to 2013

Year	Freeown Population	National Population	Freetown as % National Pop	% Freetown Households Primary Cooking Source					
				Charcoal	Wood	Kerosene	LPG	Electricity	Other
1963	127,917	2,180,355	5.9%	1.0%	91.0%	7.0%	n/a	n/a	n/a
1975	276,247	2,735,159	10.1%	18.0%	68.0%	12.0%	n/a	n/a	n/a
1989	469,776	3,515,812	13.4%	30.0%	60.0%	8.8%	n/a	n/a	n/a
2004	764,484	4,976,871	15.4%	32.2%	50.7%	10.8%	1.0%	0.1%	5.2%
2013 (est)	1,019,744	5,989,623	17.0%	72.7%	26.0%	0.6%	0.2%	<.05%	0.5%

Source: Various Census, Sierra Leone Integrated Household Surveys (SLIHS, 2003, and SLIHS, 2011) and other data from Statistics Sierra Leone.

The impacts on families in Sierra Leone that use wood as fuel with no electricity include:

- Night time hours are unavailable for activities including school homework, craft production and general income generation
- Female household members spend as much as two days a week sourcing fuel wood;
- Deforested hillsides lead to land degradation, erosion and landslides.
- Increased cases of respiratory illnesses and general ill health as a result of smoke exposure
- The high and variable cost and availability of kerosene and purchased wood for low-income families is particularly damaging for income and food security
- Access to communications and information is reduced

III. Energy demand projections

Below are the energy demand projections for the Short, Medium and Long Term. The activity plan under these periods is outlined below including projection for generating installed capacity.

Table 6: Summary of energy demand projections based on available resources				
ENERGY PROJECTIONS 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).

IV. Biomass supply potentials

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.

V. Current Policy and Regulatory Framework to improve supply side measures

Based on feedbacks at the inception and validation workshops, the issue of how commercial biomass energy could be supported legally through land set aside (either forested, or for reforestation or afforestation), and how to gain permission from the Forestry Division and other public and private entities to do so. Participants asked how ordinances and bye-laws could be created, or changed, that would allow local councils and chiefdom councils, to set aside land for forests, particularly for charcoal producers. Designating land for growing trees for wood fuels was the primary recommendation of the workshop.

Stakeholders at the validation workshop believed that setting aside land specifically for such wood fuel production was key to making wood fuel production, particularly charcoal production, sustainable. They felt that granting producer's access and rights to that land, with responsibility for forest management, afforestation and reforestation, sustainable management of these woodlands, and improved charcoal production, were key to transforming the commercial wood energy sector from unsustainable to sustainable.

However, stakeholders said that local authorities, chiefs and local wood fuel producers, lacked the forestry skills, the land management skills, the legal skills (particularly to land allocation and tenure), other technical skills (e.g., improving charcoal production efficiency), and, the technical and administrative skills to set up such woodlands. They recommended for the project to take these issues and recommendations in the project design and strengthened the capacity of the relevant technical ministries and agencies, particularly the MLCPE, FD, MAFFS, EPA-SL, MLGRD and the MOE so that making wood fuels sustainable become mainstreamed into their development plan and budget.

Current legislation and national policy, indicates that, effectively, the framework for local councils, chiefs, the Forestry Division and producers to set up such commercial forests and/or community forests already exists. Further, the policy and legal framework exists for district councils, chiefs, the FD and wood fuel producers to set up commercial wood fuel enterprises to provide economic as well as environmental benefits, to all parties. Establishing such enterprises would also be supported by:

- The Local Government Act (LGA) of 2004 (GoSL, 2005), under jurisdiction of the Ministry of Local Government and Rural Development, through local councils;
- The Decentralisation Framework under the "National Decentralization Policy" (through the Decentralization Secretariat – DECSEC) under the Ministry of Local Government and Rural Development;
- The "National Energy Policy of 2009" and the "National Energy Strategy of 2009", Ministry of Energy; and,
- Various Ministry of Lands, Country Planning and Environment regulations and policies.

Each of these can be utilized to promote and develop sustainable biomass energy enterprises.

These could be further supported by relatively new programs such as various REDD (Reducing Emissions from Deforestation and Degradation), biodiversity, and parks, and protected area establishment and management activities supported by the EU, the GEF, the UN and others, through the EPA-SL, the FD, MAFFS, local districts and several NGOs (both international and international).

The fact that most local authorities and chiefs do not know this in the context of wood fuel energy concessions is, we believe, due to the fact that, historically, almost all concessions have been used for timber production and extraction, not for charcoal or commercial firewood. However, the Forest Act (1988) explicitly states that concessions (whether within forest reserves or on tribal lands) can be used for the production of non-timber forest products (NTFP).

The fact that they have not be used for commercial wood fuel production is a matter of lack of historical precedent and experience, the fact that the demand for commercial wood fuel energy (particularly charcoal) has accelerated so dramatically over the past decade, and the fact that local capacity (both financial, technical and personnel), particularly in the Forestry Division, is over-stretched just managing the forest reserves.

The Forestry Policy of 2010 specifically sets out under Guiding Principles (Chapter 4), that focus will be on sustainability (4.1), rights-based governance (4.2), economic benefits and livelihoods (4.3), and integration (4.4). These highlight key principles to support sustainable commercial wood fuel enterprise development for livelihoods on a sustainable basis (MAFFS, 2010).

Thus, while we do not believe there are any precedents for setting up concessions for commercial fuel wood (charcoal and commercial firewood), we believe the legislative and policy framework would allow for such. There are two units within the Forestry Division, the Community Forestry Unit and the Commercial Forestry Unit, who would be responsible for working with local authorities, chiefs and producer groups to set aside land for sustainable biomass energy afforestation, forest management and utilization, if they had the mandate and the resources.

The Forestry Act of 1988 (GoSL, 1988), supported by the Forestry Policy of 2010 (MAFFS, 2010)

The Sierra Leone National Forestry Policy 2010 is the main policy that is relevant to the charcoal supply side and SLM/SFM. The objective of this policy is to establish an integrated forest sector that achieves sustainable increases in the economic, social and environmental benefits from forests and trees by the people of Sierra Leone, especially the poor and vulnerable. The policy provides information that is relevant to charcoal and SLM/SFM. The relevant information includes the following:

- a. Forests on both private and government lands are a key component of many rural livelihoods, for both subsistence and commerce.
- b. Private forest is poorly managed or being converted to agriculture or grazing land, with charcoal as a major by-product.
- c. The majority of the urban and rural poor depend on firewood as a source of energy
- d. Forest resource processors include charcoal makers.
- e. There are high rates of forest clearance on private lands for agriculture and charcoal production because forests on private land basically not regulated or managed.
- f. Population growth is leading to an increase in the demand for fuel wood.
- g. Several districts are already experiencing shortages of firewood and hence rising costs and increased burdens on women and children who collect firewood.
- h. Fuel wood and charcoal production creates jobs in the informal sector.

The Forestry Policy of 2010 goes even further. In the section on non-timber forest products (NTFP) policy number 9 stating that granting concessions to communities or commercial entities should “Contribute to the sustainable development of non-timber forest product (NTFP)-based enterprises through effective resource management, monitoring and regulation, and coordination with relevant agencies with the following strategies:

- Develop criteria to identify NTFP currently being extracted for commercial purposes and those with high commercial potential.
- Introduce a regularly revised royalty schedule for specific NTFP, and introduce sound financial management related to revenue collected.
- Conduct resource inventories of NTFP as part of the forest management planning process.
- Work with the Ministry of Trade and Industry and other relevant stakeholders, to institutionalize permitting and licensing processes for enterprises to ensure that appropriate resource inventories have been conducted, and resource management plans developed to ensure the sustainable use of NTFP in commercial enterprises.
- Ensure adequate legal and regulatory frameworks for the use and management of NTFP.” (MAFFS, 2010, p. 15).

This indicates that local councils, both district councils and chiefdom councils, can take the lead, working with the Forestry Division and local biomass producer groups to acquire and manage concessions for biomass energy (charcoal and firewood – both of which are Non-Timber Forestry Products) to benefit the councils (revenues), the producers (access to resources to generate incomes and support livelihoods) and the Forestry Division (license fees and revenues).

Given the very strong interest in local government, both councils and chiefs, in the current commercial biomass energy situation, it is believed that the forestry legislation and local government legislation provide the foundation for them to enter into ventures with the FD and local producers. They have a demonstrated strong empathy towards charcoal and wood producers because of their understanding of the livelihood benefits of the business. They communicate well with producers and producers trust most local councils and chiefs. It is believed the framework for developing commercial, community-based biomass energy production activities (forest land, improved forest management, improved harvesting, improved efficiencies of production) are in place to test pilot models of commercial partnerships between local authorities, the FD, and local producer associations/groups.

Forestry Co-Management (i.e. joint forest management), is allowed under the Forest Act and the Forestry Policy, and has been taking place in the Kambui Hills in partnership between local councils and the FD. Finally, some examples of concessions can provide guidance on how these proposed partnership enterprises might work. Numerous timber concessions have been established under this framework (Forest Act and Forestry Policy).

Several community forests have recently been set up, including those that are part of the ICRAF (International Council for Research in Agro-Forestry) community forestry activities in Bombali District, Northern Region as detailed below. Care and BioClimate (international NGOs), with US Government support, are examining options under this framework for afforestation of priority areas under the framework of both climate change (REDD – Reducing Emissions from Deforestation and Degradation) and biodiversity using community based forestry management (CBFM) and participatory forest management (PFM) approaches.

a. ICRAF's BioDev Programme

ICRAF (2014-2017) is implementing a programme to develop globally relevant interventions for achieving high value bio carbon development through the following work programmes:

- Landscape management:
 - To strengthen local capacity in governance and market institutions for effective landscape management and market integration
 - WP1.2: To increase the adoption of agroforestry and other carbon enriching farm practices
 - To improve the conservation and sustainable use of forest resources
 - To improve fuelwood use efficiency and develop sustainable wood energy systems
 - To develop effective and cost efficient carbon monitoring systems that can enable smallholder villages to access carbon markets
- To develop frameworks, approaches, and component interventions for successful high value bio carbon rural development
- To develop the capacity and policy environment to facilitate wider scaling up of high value bio carbon development approaches

b. EU's REDD+ Capacity Building in Sierra Leone

The general objective is the establishment of low-carbon and pro-poor development and achieving environmental sustainability in Sierra Leone by generating basic conditions (institutional, technical, social) and experience necessary for a sound forest governance, benefit from REDD+ initiatives according to a pro poor approach and for the development of renewable energy in Sierra Leone.

The problems identified are basically a weak forestry authority; lack of basic structures, capacities and baseline data to integrate into the REDD+ system; a general lack of awareness amongst the population of the challenges of climate change and their link to development; and a development

path that is heavily reliant on the consumption of fossil fuels. These issues will underlie the approach of the project, as reflected in seven Expected Results:

- 1: The Forestry Division (FD) of the Ministry of Agriculture & Food Security is strengthened in terms of institutional structure, policy framework, technical capacities, law enforcement capacities and logistical support so as to be able to fully assume its role in the protection and management of forest resources in the country;
- 2: Basic REDD+ readiness is completed for Sierra Leone: forests and carbon inventory is completed; Monitoring, Reporting and Verification (MRV) system for carbon reductions through REDD+ is developed; an opportunity Costs assessment for the conversion of forest areas is completed; definition of a National REDD+ Policy.
- 3: The level of awareness of climate change and its links to environmental degradation and development, particularly children and women, has significantly increased.
- 4: Sustainable charcoal production is piloted in Sierra Leone, showing its potential to reduce the pressure on forests: analysis of the economics and dynamics of charcoal production and consumption in Sierra Leone and definition and agreement of a strategy to pilot sustainable charcoal production, including identification of a charcoal production area to pilot the strategy, and implementation of pilot projects.
- 5: Mapping of the solar potential in Sierra Leone.

This GEF funded project will partner with the Forestry Division, communities and entrepreneurs under the ICRAF and EU-REDD+ programmes to promote demand side management to reduce fuel wood demand through improved cookstoves and utilize the renewable biomass as feedstock for the efficient charcoal production. This intervention will provide alternative livelihood activities for improving energy and food access to prevent forest encroachment.

VI. Current Policy and Regulatory Framework to improve demand side measures

On the demand side, the most prominent policies are Sierra Leone's National Energy Policy and National Energy Strategy (2009) which aims are to meet the energy needs of the Sierra Leone population for social and economic development in an environmentally sustainable manner. The development of renewable energy resources for both small and large-scale applications is emphasized. One of the objectives of these policies is to increase access to modern, affordable and reliable energy services as a contribution to poverty eradication. This is to be achieved through supporting the dissemination of biomass and other renewable energy technologies to increase positive impact on the energy balance and the environment, and supporting efforts to develop biomass resource in agreement with the National Forestry Policy. The policy recognizes biomass (firewood, charcoal and crop residues) as an important renewable source of energy which can provide almost all the energy used to meet basic needs of cooking and water heating in rural and most urban households, institutions and commercial buildings. The policy recognizes the following:

- Reducing energy dependency and minimizing energy imports through the use of alternative and renewable energy sources such as hydro power, biomass, biogas, solar energy, turbines and wind turbines
- Regulating the use of renewable energy sources thus contributing to the standardization and integration of different projects currently being implemented in Sierra Leone
- Supplying energy to communities in remote areas
- Safeguarding the country's energy wealth for future generations by defining and preserving "mandatory energy reserves" both from renewable and non-renewable sources
- Drafting appropriate regulations so that national operators may play a relevant role in the exploration of Sierra Leone's energy resources
- Developing balanced safety standards to ensure the continuous exploration, production and supply of energy resources
- Developing training programmes for both operators and consumers, and promoting the use of more environment-friendly energy sources
- Charcoal is generally produced on non-state land.
- Biomass (firewood, charcoal and crop residues) provides almost all the energy used to meet basic needs of cooking and water heating in rural and most urban households, institutions and commercial buildings and it is the main source of energy for rural industries.

- Trading in biomass energy, especially charcoal contributes to the economy in terms of rural incomes, tax revenue and employment.
- Most of the traditional energy technologies (wood and charcoal stoves and charcoal production kilns) currently used in Sierra Leone are inefficient.
- Charcoal production and transportation is not properly regulated and the disposal of biomass waste by burning, without extracting the energy content, is a common practice countrywide.
- The provision of incentives for the growing of energy crops contribute to reforestation and sustainable use of biomass.
- There is a need for developing appropriate legislation to operationalize policy measures which include regulation of certified sustainable charcoal production and transportation
- There is a need to license and standardize and certify charcoal production and transportation and encourage its commercial production in an efficient and sustainable manner.

VII. Agriculture sector

The agriculture sector employs 60 percent of the population (FAO, 2012). The main farming system in Sierra Leone is subsistence farming. The system is still mainly rain-fed and characterized by low productivity. Agriculture value added was 49 percent of the country's GDP in 2010, and 12.1 percent of total exports were from agriculture. Rice is the main crop produced in Sierra Leone, followed by cassava and to some extent palm oil. Cocoa beans and coffee are the main export crops. In the last 11 years, production of all of these crops has increased. Rice production levels have risen 68 percent, cassava 31 percent, and palm oil 20 percent. Livestock is also an important component of Sierra Leone's agricultural sector. Permanent pastureland accounts for 31 percent of total land available according to 2008 statistics. In excess of 7,800,000 head of poultry, 730,000 goats, 620,000 sheep, 470,000 head of cattle, and 415,000 horses are raised in Sierra Leone for meat, milk and egg production.

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 7.

Table 7: 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	1,062

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.⁷ 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.

Palm Oil Products

According to the Sierra Leone Investment and Export Promotion Agency (SLIEPA),⁸ there could also be potential for palm oil plantations. Palm oil could be used 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 (FAO, GBEP, 2011).

Regional Alignment and Harmonisation

In recognition of the critical need to improve global access to sustainable, affordable and environmentally sound energy services and resources and to coordinate activities to increase awareness of the importance of addressing energy issues, the United Nations Secretary-General launched a global initiative on Sustainable Energy for All (SE4ALL) in 2011. The initiative is aimed at mobilizing action from governments, the private sector, and civil society around the following three objectives to be reached by 2030: providing universal access to modern energy services; doubling the global rate of improvement in energy efficiency; and doubling the share of renewable energy in the global energy mix.

For Sub-Saharan Africa (SSA) biomass energy accounts for more than 70% of total final energy consumption. The International Energy Agency (IEA) gives the following final energy consumption figures for 2010 in million tonne of oil equivalent (Mtoe): SSA consumes a total of 396.5 of which biomass is 288.3 (73%), and of which residential biomass is 248.7 (63%). About 80%, of the population of Sub-Saharan Africa (SSA), nearly 700 million people, rely on biomass for cooking, particularly fuelwood in rural areas and charcoal in urban areas.

Given that biomass accounts for more than 50% of energy consumption in most if not all of SSA countries, the African response to the SE4ALL initiative, led through a partnership between the NEPAD Planning and Coordinating Agency (NPCA), the African Union Commission (AUC), the United Nations Development Programme (UNDP), and the African Development Bank (AfDB), has developed the African Sustainable Charcoal Policy Framework (ASCPF) to guide the implementation of SE4ALL in Africa. In recognition of the varied conditions across African countries and regions, the

⁷ 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

⁸ SLIEPA: Sierra Leone Investment Outreach Campaign. Opportunities for Investors in the Oil Palm Sector Update: February 2010.

ASCPF is intended to serve as guidance to member states and Regional Economic Communities (RECs) on how to formulate charcoal policies. The objectives of the ASCPF are twofold:

- i. to enhance awareness in Africa, particularly among African decision-makers and policymakers, about the potential of sustainable charcoal in contributing to energy security; and
- ii. to build a consensus on a shared framework that inspires and provides guidance to individual countries and regions in developing charcoal and fuelwood policies and regulations intended to formalize and modernize the charcoal sector along all stages of the charcoal value chain.

The fifteen member states of the Economic Community of West African States (ECOWAS) have expressed the need to mainstream renewable energy and energy efficiency into their national policies. In this regard the ECOWAS Renewable Energy Policy (EREP) and the ECOWAS Energy Efficiency Policy (EEEP) were adopted by the ECOWAS Council of Ministers and the Authority of Heads of State and Government of Energy in 2013. The vision of the EREP and the EEEP is to secure an increasing and comprehensive share of the Member States' energy supplies and services from timely, reliable, sufficient, efficient, cost-effective uses of renewable energy sources enabling universal access to electricity by 2030 and a more sustainable, efficient and safe provision of domestic energy services for cooking. The EREP and EEEP recognize that woodfuels (firewood and charcoal), which are used for domestic cooking purposes and commercial applications, as one of the renewable energy options that are not utilized efficiently but have the potential for development in the ECOWAS region. In the region, woodfuels represent the bulk of the final energy consumption, reaching up to 70-85 % in some countries. Within these policy frameworks and specifically under the programme for Supporting Energy Efficiency Activities in West Africa, a clean cooking initiative was launched in October 2012. The West African Clean Cooking Alliance (WACCA) aims to ensure that the entire population in the region has access to clean, safe, efficient and affordable cooking fuels and devices by 2030. WACCA will explore both the supply and demand side of the cooking chain and introduce efficiency where necessary to improve the fuel supply and demand characteristics for better access and improved living conditions. This GEF funded project will partner with WACCA to mainstream the demand side management of biomass and to develop regional harmonization on standard and label for improved cookstove and charcoal kiln.

1.4 Situation Analysis on the Use of Fuel woods and Cooking Stoves in Sierra Leone

After Sierra Leone's 1991-2001 civil war, the trade in firewood became increasingly commercialized, with large numbers of villages near highways or urban centres becoming involved in harvesting and commercially trading the commodity. However, many urban vendors state that in recent years there has been a decline in firewood sales, largely due to an increase in preference for charcoal by consumers. Interestingly, this trend has been partly driven by landlords, who now increasingly ask their tenants to use charcoal in their compounds to help reduce smoke damage and fire hazards. Many participants interviewed also noted that the introduction and availability of the WonderStove for charcoal cooking had also contributed to the reduction in demand for fuelwood, as it drastically reduces cooking times especially when compared to traditional cooking made on three stones stoves. In response to these changes a number of former firewood vendors have now moved into the charcoal business, and in the longer term it is likely that there will be a continuing decline in the use of firewood in urban markets.

Southern and Eastern Provinces: A quarter of Freetown households (approximately 100,000 households), and more than half of the households in Bo, Kenema, Bonthe, and Makeni currently use wood (estimated 150,000 households). Furthermore, a number of Freetown Rural – peri-urban households use firewood for cooking. Koidu, Kailahun Town, Moyamba Town, Mattru Jong and Pujehun Town had smaller markets compared to Bo and Kenema Towns. Although most vendors had only entered the trade in the last ten years, there were a couple of vendors in both Bo and Kenema towns who had been involved for over 30 years. Most of the vendors were women.

Northern Province: Commercial firewood production is mainly carried out by majority of Northern Province villages that are located near major highways and urban centres. Firewood is sold along most of the highways across the Province, and is purchased either in small amounts for household consumption by passing private motorists, or in large amounts by returning empty trucks for

commercial consumption or resale in Freetown and, to a lesser extent, in Makeni. In general, however, it appears that firewood produced in villages within 15 kilometres of a major town is often transported by the villagers themselves on foot for sale in the local urban market.

Tree Species Utilized: Although there is a great deal of diversity in the number of tree species harvested, firewood is generally classified into three broad categories: farm wood, forest wood, and mangrove wood. Farm wood, by far the most common type of firewood produced, is harvested as a part of the farming cycle and generally all tree species on the farm are used (following farm clearance and burning) to make firewood bundles. The introduced species *Gmelina arborea* was noted as a common tree for making farm wood, although this was not because it is considered to be an ideal firewood tree, but rather due to its abundance and ubiquity across the province. Indeed, previous research has noted *Gmelina arborea* as having particularly poor qualities as a firewood stick.

Harvesting Methods: The vast majority of firewood is harvested as part of the farming cycle and acts as an important supplement to agrarian livelihoods in Sierra Leone. Farm Wood is a by-product of farming and is harvested by women after their husbands have cleared the farm bush, allowed the sticks to dry and set the land on fire. After the farm is cleared, women then collect the burnt firewood, cut the wood into practical lengths and widths, and then bundle them into individual head loads.

Prices and Fees: Firewood attracts the least amount of fees when compared to poles and charcoal production. Firewood vendors are supposed to pay Le 50,000 to Le 80,000⁹ per year to register their business with the Freetown City Council (FCC) but some do not pay this fee, relying on 'unofficial' payments instead. Similarly, truck drivers are supposed to pay Le 20,000 per cord of firewood to the Forestry Division at checkpoints but generally a lesser amount is paid and no receipt is given. Those transporting mangrove firewood into the wharves need to pay a Le 5,000 to the dock official at the wharf, a Le 5,000 fee to city council for registration and another Le 5,000 for the offloading of the boat. Farm wood is sold in bundles and piles, while mangrove wood is always sold by the dozen. A one dozen bundle of mangrove wood costs between Le 2,000 and Le 4,000 (depending on the quality). A bundle of forest and farm wood (five to eight sticks) sells for between Le 500 and Le 1,000, while a pile (20 to 50 bundles) sells for between Le 12,000 and Le 24,000.

Urban Markets: Firewood is most commonly sold in urban centres at Le 2,500 per bundles of four to six sticks while at the source point villages bundles can be as low as Le 800. Often, however, bigger bundles are also made and sold at higher prices. Larger scale urban vendors usually purchase firewood in piles (equivalent to 20 bundles) at a price of around Le 10,000 and then break these piles down into bundles to be sold at Le 2,500, yielding a roughly 50% gross profit margin (Le 10,000) per pile (less market dues, transport costs, etc.).

Environmental Impacts: Firewood harvesting appears to have the least environmental impact when compared to poles and charcoal production. The vast bulk of firewood is harvested as a part of the farming cycle, while firewood that is collected from forests is generally harvested from dead trees or fallen branches. Both practices have limited or no impacts on forest cover of themselves. Hence the percentage of non-renewable fuelwood is estimated at 60%. Some villages do use girdling techniques to harvest forest firewood, a method that can potentially have negative forest impacts, but currently this is only being practiced in a very small number of villages and at a very limited scale. An important environmental concern surrounding firewood harvesting is the use of mangrove firewood, mainly for specific Freetown Peninsula food production industries. Due to the sensitivity of mangrove ecosystems along with the substantial size of the trade in Freetown, there could be some environmental impacts concerns. The potential to provide alternative fuelwood to mangrove to alleviate this problem will be explored in this GEF funded project.

Vendor Profile: All of the large-scale firewood vendors were either the sole owners of their businesses or were in partnership with their relatives. The majority of vendors are women aged between 32 and 69, although there are men trading in mangrove firewood on the wharfs. Their customers include individual households, bakers, restaurants, and fishmongers (who use the wood to dry their fish). Some vendors also sell their firewood to stone miners, who use small fires to heat

⁹ Exchange rate: 1 USD = 4,200 Le.

and crack the stones so that they are easier to break. Most of the vendors store their firewood outside and it is therefore highly susceptible to theft.

Firewood Types: All three broad types of firewood are sold in Freetown: mangrove wood, farm wood and forest wood, of which farm wood is by far the most common. While a wide variety of tree species are used to make farm and forest wood, mangrove wood is taken from just two species: black mangrove, which is the most common and red mangrove. Farm wood comes by road from the provinces and is harvested as a part of the farming cycle, while mangrove wood is harvested from swampy areas along Sierra Leone's coast, transported to Freetown by sea and sold at the various wharves. Mangrove wood tends to be most popular with fish traders to use for drying and with bakers throughout Freetown, while farm wood is used mainly for domestic cooking. The mangrove firewood vendors have a local association at each of the wharves and generally operate in an amicable, though competitive manner. There is no association for the other firewood vendors in Freetown.

Key Source Points

The majority of firewood in Freetown comes from Kambia Port Loko, Moyamba and Tonkolili Districts as well as from along the lengths of the Bo-Freetown, Makeni-Freetown and Kamakwie-Makeni highways. While mangrove wood comes almost exclusively by boat from Port Loko and Kambia districts, farm wood is transported to Freetown via the road network. Most vendors hire trucks for transportation and do not visit the provinces themselves. The cost of transporting a truckload of firewood to Freetown is generally between Le 350,000 and Le 650,000 and usually a few hundred bundles are transported per trip. As police do not let the trucks of firewood enter Freetown during the day, most wait at Waterloo until late in the night before transporting their produce into the city. In contrast, mangrove wood vendors pay around Le 250,000 per boat trip for transporting their produce. They usually transport a few hundred bundles of mangrove wood per trip.

A commodity in decline: One of the most interesting aspects of the firewood trade is that it is being increasingly being displaced by charcoal as the preferred household fuelwood in urban areas. This trend has significant implications as many tree planting program around the country have a focus on tree species for firewood, but charcoal producers tend to target very different tree species. It is important to note, however, that charcoal is unlikely to ever completely replace firewood as an urban household fuel. This is at least partly because in rural areas firewood is the primary fuel consumed while charcoal (in those areas in which it is produced) is solely a traded commodity to be sold to urban vendors or residents. Thus, as individual rural residents or families move to Freetown they are – at least initially – likely to maintain preferences for more familiar fuel types. As well, charcoal is also unlikely to fulfill all different cooking needs that different types of firewood provide (i.e., variation within smoke quality and quantity, combustion, calorific value, etc.). This is perhaps most noticeable in the case of mangrove wood which has supplied niche markets in Freetown providing cheap fuel for bakers and fish mongers for smoking since the early 1980s, if not earlier.

Inconsistent fees: The official fees for firewood producers and vendors according to the Forestry Division's 2008 regulations are Le 25,000 for a vehicle load transport permit (which, although the regulations are not specific, is presumably charged per trip). As well there is a fee of Le 20,000 per cord, of firewood to be paid at checkpoints for large loads. Finally there is a Le 500,000 annual retailers' fee, although it is unclear if this includes firewood vendors or just board/timber vendors. In any event, none of the firewood vendors/transporters reported ever paying transport permits or retailers fees. Fees paid at checkpoints also appeared to be based not on cords, but on ad hoc assessments at each particular checkpoint. On the whole, there are massive inconsistencies in the fees paid with some transporters never passing checkpoints, and therefore never paying fees to forestry, while others pass multiple checkpoints paying a variety of (usually informal) fees.

Summary of Cookstove Use

- Indoor Air Pollution (IAP) is caused mainly from using firewood with rudimentary cooking devices and from living in a smoky environment for perceived health and functional benefits
- While there is some awareness of IAP among the Government and NGOs, there is very low awareness in the general population

- Efficient cookstove and clean energy programs are still in the early pilot phase and face capacity and cultural challenges to become scalable and sustainable
- Consumer cooking habits and preferences vary based on urban and rural living as well as income levels; strong cultural attachment to smoke, abundant supply of firewood and high clean fuel costs create high barriers to switching from firewood
- The cookstove industry is in a very elementary stage with small scale clay cookstove producers in a few rural areas and a few steel electric and LPG stove importers in the larger cities.

Baseline survey on household energy usage in Sierra Leone remains very scanty. However, Environmental Foundation of Africa (EFA) is currently conducting a detail household energy usage survey as part of the DFID funded CKDN project 'Renewable Energy Empowerment in Rural Sierra Leone (REESL): A Vision to Electrify Rural Sierra Leone'. The REESL project was inspired by the ongoing Rural Energy Activating Livelihoods (REAL) project, which involves the installation of solar equipment in 40 communities in 4 out of 13 districts in Sierra Leone. While REAL is about installation of RE equipment and training community people in a part of Sierra Leone, REESL, seeks to establish a credible information resource base, that contributes meaningfully to policy formulation and planning for the current and future investments in the energy sector. REESL therefore is an innovation process, involving national-level gathering of data on the availability and applications (plus socio-economic implications) of innovative renewable energy (RE) technologies in Sierra Leone. The project recognizes that the knowledge, expertise and experience needed to develop National Policy regarding RE in Sierra Leone is currently fragmented between various stakeholders.

The main outputs of the study will include: i) An established RE Knowledge Data Base; ii) Testing of the Knowledge Base by public, including experts through an Innovation Workshop and Renewable Energy Fair; iii) Engaging policy and decision-makers to increase support and investment in RE innovation and iv) Dissemination of RE information and knowledge.

The inventory data for Second National Communication report have indicated that there is still abundant biomass supply in most parts of the country, except in the Freetown district. Because of this abundance, fuel-wood is, and for some time to come will continue to be, the cheapest cooking fuel compared to liquefied petroleum gas (LPG), kerosene, and electricity, even after accounting for different cooking equipment efficiencies.

Despite of this abundance and the low opportunity cost for biomass utilization, the responsible policy for the GoSL to pursue must result in a reduction or eventual curtailment of household fuel-wood use. The rationale for this policy is based on:

- i. The certainty that the current positive supply-demand balance will change in the future, with population growth and increased pressure on wood supplies as forest lands are converted to agriculture; and
- ii. The adverse impacts to public health from indoor air pollution (IAP) associated with use of fuel-wood in traditional cookstoves.

SNC report reiterates the urgent need for clean cookstove and fuel interventions to reduce IAP exposure as well as reduce the dependence on firewood as fuel:

- A clean cookstove alone may not be enough to reduce IAP exposure, the solution should be holistic to address uses of fire and smoke beyond cooking (i.e. lighting, repellent, drying, traditional practices) reduction in the very large amount of time spent cooking each day and greater ease of cooking, in particular benefiting women and girls;
- A clean cooking program should include an awareness program around the dangers of smoke and around the health, economic, and ecological benefits from clean cookstove
- Government may support a cookstove initiative that aligns with its targets, integrates with existing programs and does not over extend limited government resources
- Several clean cookstove projects were launched in 2011 by NGOs and UN agencies that could benefit from coordination to align goals and strategy, to share learning and avoid duplication of effort
- Consumer segments need to be understood in depth and solutions should be tailored for each segment's needs and access to technology

- Developing a sustainable and scalable clean cookstoves and fuels industry is a long term effort and will require a commitment of 10-15 years

Compared with fuel-wood, modern fuels, including LPG and kerosene, have lower emissions and are more convenient and cleaner to handle. It is almost inevitable that demand for modern fuels, particularly LPG, will increase dramatically in Sierra Leone in the coming years, as economic conditions improve and a middle class emerges and expands. Most developing countries favor this modernization outcome and adopt policies to accelerate the transition from fuel-wood to modern fuels.

Rationale for incentivizing energy access

World experiences have shown that subsidizing the price of LPG or kerosene fuel could lead to the following 'unintended' consequences: (a) possible diversion of the fuel for non-cooking uses, such as transport, can occur (this is more likely to happen with kerosene than LPG); (b) possible smuggling and sale of the fuel outside of the country; (c) difficulties in limiting benefits to low-income households or crafts and professions; and, most important (d) the subsidy burden to the Government is likely to become unmanageable in the future. As shown worldwide, 'addiction to subsidy' can be extremely difficult to withdraw or even reduce once they become critical to consumer choices for fuel use (e.g. Nigeria, Indonesia). Furthermore, subsidy can distort the market and crowd out private sector participation whilst deterring end users to pay the full market price and the incentive to adopt more resources efficient production system or services.

It is often more effective, with fewer undesirable side effects, to incentivize access rather than consumption. Incentivizing bioenergy access calls for programs that part rebate the equipment or production system that are needed for early movers and adopters to champion a 'tipping point' for market transformation to resources efficient products and services and fuel switch (e.g. new stove purchases, efficient charcoal kilns, deposits for LPG cylinders, biodigester, briquettes, furnace) by remove supply risks, improving demand and facilitating fuel logistic and market support but keeping fuel prices at market levels. This will create a level playing field for new bioenergy entrants to compete fairly, bolstered through a transparent and coherent standard, certification and label programmes. The financial exposure of the Government for an equipment rebate program can be determined annually in advance, unlike fuel subsidy programs that are entirely subject to the vagaries of fuel market fluctuations and exposure to corruptions. The Government may terminate the equipment rebate program at almost any time with minimal public inconvenience.

Market segmentation

Micro-enterprises and cooperatives are in need of vital market research to orient products and services to the market. Based on projected population data for 2012, an analysis was carried out on market segmentation based on household incomes, fuel for cooking and degree of exposure to indoor air pollution (IAP) in Sierra Leone. The market can be segmented into 5 categories:

i. Segment 1 Affluent: These consumers are in the top 3% of income level of more than USD 20,000 per year (about 30,185 of the 1,006,176 households) and most currently utilize clean-burning LPG, kerosene, and electric cookstoves and their exposure to IAP are minimal. This group can afford higher priced products and fuels; no rebate is needed as there is high willingness to pay for improved cookstoves and will switch if product provides financial or health benefits. But there is still possible perception issue with LPG safety.

ii. Segment 2 Urban Middle-Class: This group with annual income of USD 3,600 to 20,000 represents 10% of total 1,006,176 households (about 100,617 households) often hold down regular or semi-regular employment and are likely utilizing wood for current cooking needs but have the disposable income to purchase an improved solution. Their exposure to IAP is considered as moderate. These consumers could possibly afford higher priced products and fuels; no rebate are needed as there is moderate willingness to pay but will switch if product provides financial or health benefits. Initial demand from this and the affluent group will help to generate critical mass for rapid urban and peri urban market growth and spur innovation that will contribute to reduction in production cost. But there is still perception issue with safety of LPG.

iii. Segment 3 Urban Poor: 17% of total households (about 171,050 households) are classed as urban poor (USD 600 to 3,600 per year) who are squeezed by rising living costs in urban centers. These consumers have very limited disposable income but do not face the same level of logistical and awareness issues as the rural poor. Most of these consumers cannot afford higher priced products and fuels and there is low willingness to pay but would switch if product provides very clear benefits in money or time saved. Hence some rebate may be needed to influence coupled with strong awareness campaign on the benefits of clean technology.

iv. Segment 4 Rural Middle-Class: 27% of total households (about 271,667 households) are benefiting from lower living costs in rural areas and often self-employed (USD 600 to 5,000 per year), these consumers have some disposable income but limited geographic access to cleaner fuels, who can possibly afford higher priced products and fuels but with low willingness to pay and hence have significant exposure to IAP. They may switch if product provides very clear financial or health benefits, hence demonstrations and awareness campaign through radio, word of mouth and advertising will be very critical to spur demand and rural market growth. There is still perception issue with safety of LPG.

v. Segment 5 Rural Poor: Living below the poverty line and sometimes relying on subsistence farming for survival (< USD 600 per year), these consumers currently collect firewood and have higher financial and cultural barriers to a fuel switch. There are about 432,656 households that represent 43% of the total households with extreme exposure to IAP. These end users are unlikely to afford higher priced products and cleaner fuels like charcoal with low willingness to pay hence some upfront rebate will be needed with gradual reduction as the project progresses. There is a need for heavy investment in awareness raising in order to encourage the switch to cleaner technology on the basis of improving health and reducing exposure to IAP and lower health bills and less sick days. This can be done through demonstrations using Women group to create local demand where their efforts will be rewarded through a voucher scheme. These will help to mitigate the supply/producer risk. Most of the poor do not have access to microcredit.

The impact on firewood consumption and harvesting is expected to be substantial. An efficiency saving of 40% will result in 1,360 kg less firewood use per year for each stove-using household, reducing deforestation and the pressure on natural resources in target areas. GACC (2012) has reported that there are multiple reasons that women will be motivated to shift to using fuel efficient stoves, but in particular the practical benefits are likely to be among the strongest push-factors: greater ease of cooking was highlighted by 91% of current stove users; 64% of stove owners said reduced smoke was a benefit of the stove, and 55% said the stove was safer than using an open fire.

Other time-saving benefits will also be important, including less firewood use and associated chopping of firewood and firewood collection. The economic benefits of shifting to fuel-efficient stoves will likely be less important than the factors listed above, due to the very low number of households' currently purchasing firewood. The health benefits of fuel-efficient stoves have the potential to be a major factor in persuading women to shift cooking practices, but such promotion needs to be accompanied by educational activities to improve understanding about the negative health implications of open fires and indoor smoke pollution.

Because of the scale of dependency on open fires in the country the impact of a successful fuel-efficient stove programme is likely to be huge and it will benefit women and girls in particular:

- A reduction in the very large amount of time spent cooking each day and greater ease of cooking, in particular benefiting women and girls;
- Reduced exposure to smoke, and associated health problems;
- Reduction in time spent collecting firewood, benefiting all household members; and
- Improved livelihood

Working with institutions that have existing health networks to promote the health benefits of stoves, through the Ministry of Health would likely have particular benefits in terms of outreach and take-up of stoves.

1.5 Survey of Industries Using Fuel Wood

During the preparation stage of this project document (PPG phase), a cottage industry rapid survey was conducted to establish a baseline situation of industries that are using substantial wood as raw materials or using fuel wood or charcoal as a source of energy to operate the manufacturing or processing units. The preliminary data collected was used to come up with a plan for interventions to green up the value chain by introducing energy efficient technologies that would lead to a reduction in utilization of firewood or charcoal and, where necessary, also use waste products from wood-based industries to generate energy that can be used in the industry itself. Where possible, this GEF funded project will also explore means to improve the sanitation and hygiene of the food processing practices. The thermal energy is often an overlooked sector, as this micro small medium enterprises (MSME) sector has a revenue source that could stimulate market transformation and innovation where productivity, hard work and innovation could be rewarded. Strengthening the business foundation of these MSME in a post war and nascent sector would ensure the future engine for green growth and inclusive employment.

Fish drying and smoking: WHL have previously developed kilns for smoking fish and this project will partner with WHL to scale up more kilns. A typical fish smoking enterprise produces between 100kg of fish/day. One firm employs about 6-8 part time persons. This consumes about 1 truck of lorry (1 ton) of firewood which last for two days (i.e. 300 to 500 kg per day). The employees often complain about sore eyes and respiratory problems associated with working in smoky conditions from the fumes and smelly fumes from the burning of used engine oils for starting the fire. The respondents are keen to improve their furnace and are willing to contribute towards the cost of the more efficient furnace.

Gari processing: Gari is a popular West African staple food made from the roasting of dried cassava starch powder. A typical gari enterprise produces between 50 to 200 kg of gari/day with some part time workers. The stoves used are rudimentary, inefficient and create lots of smokes and take about 10 kg to produce 1 kg of gari and consumer about 500 to 2,000 kg of fuel woods per day. The respondents are keen to improve their stoves and are willing to contribute towards the cost of the more efficient stoves.

Tobacco curing: Tobacco has long been the primary cash crop and the main source of income for farmers. Before sending the tobacco to the market, it is cured and dried. The method of drying is crude and tobacco growers use a lot of wood to smoke-dry the harvested tobacco. Some key finding of the tobacco curing include the following: use about 300 to 500 kg of fuel wood per day costing USD 40 per month; cost USD 1 per kg of raw tobacco selling at USD 4/kg and dry about 250 kg of raw tobacco per day.

Salt production: Salt in Sierra Leone is still produce in the traditional way by communities located near coastal areas. A typical salt making community is made up of a cluster of 10-30 households producing salt. Often a household owns one hut with thatched or zinc roof on earthen floor. The salt brine taken from seawater is boiled in a flat zinc pot about 1 m x 0.5 m with a clay support. The boiling produces a lot of caustic smoke that can be irritating to the eyes and throat. One household typically produced 2-3 containers of salt per day and the salt is sold through a middle person to big city for \$ 3 - \$ 5/container. One household cooked the salt for 6-8 hours per day that uses about 1 cart of fuel wood (40-90 kg) per day. Often the fuel woods were collected from bushes near the house and sometime buy from vendor. It takes them about 4-6 hours per day for a household to collect firewood because the bushes are getting sparse and they have to travel further. The cooking method produces a lot of ashes that they are stock piled near the hut. Often these ashes are not used.

Bakeries: Whilst some modern bakeries that supplies big cities use electricity, the majority of small and medium bakeries still rely on traditional method of baking using furnace/stove that rely on firewood. Amount of firewood consumed ranged from 300 to 700 kg per day that is supplied by dealer. There is opportunity to introduce more efficient cookstove that will reduce firewood usage and cleaner and hygienic environment.

1.6 Institutional stoves for schools

World Food Program (WFP) – schools feeding program: WFP has been operational in Sierra Leone since 1968. WFP operates in the Southern, Northern, Eastern and Western regions with an

office in Freetown and one sub-office located in Kenema. In collaboration with the GoSL and other partners, WFP pursues the goal of feeding the hungry poor by supporting reconstruction and rehabilitation following the devastating civil war in the 1990s. In 2011, WFP reached 696,271 vulnerable people across Sierra Leone with 15,800 million tonnes of food.

The source of energy for cooking in all supported schools is firewood and the cooking appliance used is the traditional three firestones. Other Public Institutions using firewood for cooking instead of charcoal are prisons department and government hospitals. This GEF funded project will partner with WFP and Ministry of health and Ministry of Education to provide alternative and more efficient institutional stove for cooking.

Table 8: Total number of primary schools benefiting from the WFP feeding programme		
Districts	Chiefdoms	No. of School Feeding
Pujehun	6	98
Bonthe	9	106
Moyamba	5	129
Bo	5	104
Kenema	10	111
Kono	8	106
Kailahun	7	96
Bombali	5	82
Kambia	5	147
PortLoko	5	166
Tonkolili	5	162
Western Area	2	153
Total		1,460

The total number of WFP supported primary schools is 1,460 (Table 8). The implementing Partners (NGOs) contracted by WFP are Plan International, World Vision and BRAC. The Catholic Relief services (CRS) with funding from the United States Department of Agriculture (USDA) is responsible for the school feeding program in Koinadugu District.

This proposed GEF project seeks to build upon the initiatives undertaken by WFP to further scale up institutional cook stoves in the schools, prisons and hospitals.

1.7 Situation Analysis of the Use of Charcoal in Sierra Leone

Improvements in the conversion of biomass to charcoal show a tremendous potential for reductions in the associated GHG emissions. This potential consists in both avoided consumption of non-sustainable biomass and mitigation of CH₄ emissions during the production process. In Sierra Leone alone, over 74 Mt of charcoal were estimated to be consumed in 2012 (Table 9). The strong and growing demand for charcoal fuel is an important cause of deforestation.

Due to a lack of affordability for other modern fuel types, a switch to fossil fuels is presently highly unlikely under business as usual. Due to the affordability and convenience domestic consumers of fuels in Sierra Leone are increasingly switching to charcoal, especially in urban areas. The

production of charcoal in Sierra Leone is however overwhelmingly dominated by the “informal sector” in which small scale producers use traditional technologies to produce charcoal. Wood is almost always sourced from natural forests and very often harvested illegally, despite forest management systems implemented in some countries. An improved and sustainable charcoal production chain could substantially decrease the wood consumed per tonne of charcoal and reduce the associated CH₄ emissions.

Based on the field visits, interviews and secondary information, this section provides a brief overview of the history of charcoal sector in Sierra Leone with respect to number of traditional kilns, value chain, volume of trade and lessons learned from past program.

The historical development of the charcoal sector has been described in detail in the EOP report (2012). This report is based on predominantly on over 150 interviews with: 27 urban charcoal vendors across the Southern and Eastern Provinces; 24 urban charcoal vendors across the Northern Province; 41 vendors along the Freetown Peninsula; and 64 charcoal producing villages.

Southern and Eastern Provinces: Unsurprisingly, by far the biggest urban markets in the Southern and Eastern Provinces are in the key urban centers of Kenema and Bo, while Koidu also has a fair-sized trade. In contrast, the much smaller settlements of Kailahun, Koidu and Moyamba towns have only a couple of vendors each and there are none in either Pujehun town or Mattru Jong. Most vendors had only joined the trade during the past decade and in Kenema Town and Bo Town the trade has been growing rapidly.

Northern Province: The main center of charcoal production in Sierra Leone are Kambia and Port Loko District's. While some of the charcoal produced in the district is sold for consumption in Port Loko Town and neighboring Kambia District, the vast bulk is supplied to the Freetown market. Most of the charcoal producing villages in the district is therefore located in close proximity to highways for ease of transportation, though a modest amount is transported via boats. A few villages also occasionally transport their bags of charcoal on foot to Port Loko Town.

Tree Species Utilized: Charcoal is generally classified into two broad types: ‘iron coal’ and ‘soft coal’. Iron coal is made from harder tree species (i.e., *Lophiira lanceolata*, *Pterocarpus erinaceus*, *Parinari excels*, *Terminalia albida*) which tend to yield high quality (longer lasting) charcoal that is therefore in greater demand and more expensive. Soft coal is made from softer tree species (i.e., *Gmelina arborea*, *Mangifera indica*, *Anisophyllea laurina*) that yield a cheaper, faster burning type of charcoal. The majority of producers have quite specific tree species preferences and generally only make ‘soft coal’ when ‘iron coal’ tree species are not available at their production sites. The most popular tree species targeted to produce high quality charcoal across the Northern Province are *Lophiira lanceolata* and *Pterocarpus erunaceus*. *Gmelina arborea*, is also reasonably popular for charcoal production, however this is not due its quality for charcoal making, but rather because the tree is so common in the province.

The wood for charcoal production is usually harvested from nearby forests, although wood from farm clearance are also used at some times and in some places. In some cases charcoal makers help farmers to clear their farms in exchange for use of the wood cut. At larger production sites chainsaw operators are often employed to harvest the wood, and these operators usually charge between Le 100,000 and Le 160,000 per day for their services (along with additional ‘encouragements’ in the form of cigarettes and alcohol). Indeed, in at least one village, the chainsaw operators had stopped harvesting boards to shift completely to cutting for charcoal production as they found it to be more profitable. *Grevillia Robusta* is one such tree that produces a hard red wood, does not coppice and can be used for fuel wood production and furniture.

Charcoal Production Methods: All charcoal production methods involve placing piles of collected sticks inside a charcoal oven of dirt and grass (in the form of a pit or mound). A variety of holes are created in the sides of the oven to allow fire to pass through either underneath the pile or in the middle of the oven. The ovens are then left to burn for a few days in order to create the charcoal. Charcoal producers will often sleep next to their ovens during the process to guard against thieves. These ovens can produce between 5 and 300 rice bags of charcoal depending on their size. Larger pits tend to be used in Port Loko and Kambia Districts where the bulk of Sierra Leone’s charcoal production occurs, while small pits are used in villages in Koinadugu and Tonkolili Districts where

farming is still the dominant livelihood activity. After the charcoal has been produced the pits/mounds are opened up and sprinkled with water to allow the charcoal to cool down and the charcoal is then shoveled into rice bags. Some of these bags are sold at the production site, others are transported to the village for sale, some to the highways, while others are picked up for transport straight to urban sites around the country, particularly Freetown. The main tools used for such charcoal production are axes, machetes, rakes, shovels, rice bags, and, at some sites, chainsaws.

Charcoal production in dirt mounds (sometimes called the open method) tends to be the quickest method. It takes about two weeks to prepare the oven, and then about three days for the oven to burn, yielding between 5 and 30 bags of charcoal. For charcoal pits there are a variety of different methods of preparation. The pin-pin method involves placing the sticks upright (which helps to drain water from the sticks quicker). It can only be done with small amount of sticks and takes about a couple of weeks to prepare and about three days to actually 'cook' the charcoal. This oven can yield between 15 and 20 bags and is popularly known as the 'avoid conflict' method, as it allows a producer to make charcoal quickly in order to pay off debts or provide money to their wives. For larger pits the lay-lay and pyramid methods are often used, which involve lying sticks flat or stacking them in a pile or pyramid respectively. The pits usually take a few weeks to prepare and burn for 5 to 7 days (varying depending on their size). They can produce anywhere between 60 and 150 bags of charcoal depending on their size. The largest charcoal ovens are the Loko Pits, which are only utilized in Port Loko District. These are created with large teams of charcoal makers and involved digging large rectangular pits. They can take over a month to prepare and over a week to burn, but the end result can be anywhere between 200 and 300 bags of charcoal per pit.

Traditional kilns: Efficiency of the traditional kilns ranged between 10 to 20% and have the following characteristics: (i) they are not sedentary as the kiln is typically built on the site of wood harvesting and abandoned after one carbonization process; (ii) mud is the prime material of the kiln shale and no bricks or metal sheets are used; (iii) no metallic chimney is used. These technologies are characterized by: a non-sedentary kiln (the kiln is abandoned after the pyrolysis process); (iv) These technologies include in particular the earth pit kiln, the earth mound kiln as well as the variations of these kilns which are sometimes found under different names.

Prices and Fees: At the source points, charcoal is usually sold for between Le 8,000 to Le 12,000 per rice bag (the cost is an extra Le 1,000 to Le 2,000 per bag if the buyer does not bring their own rice bag). This is known as the 'bush price' as charcoal harvesting sites are usually two to three kilometres away from villages. Kambia and Port Loko Districts tend to be the cheapest districts for charcoal and in one Chiefdom in Kambia there has even been an agreement made between all charcoal producers that their bags should be sold at Le 5,000 each. As prices have remain constant over the last 10 years there is little incentives to introduce efficiency.

Urban Markets and transportation: The urban markets for charcoal are limited in size in the Northern Province and most of the charcoal produced in the province is transported to Freetown. Nevertheless, there has recently been some notable growth in both the number of charcoal vendors in the country's various urban centres and the quantity of their sales. Transportation of charcoal is often unorganized and frequently involves overloaded trucks of varying capacities. The charcoal is transported to temporary storage sites in and around urban centres from which it is then distributed through a network of local retailers. Transportation also involves a large spectrum of people looking to take advantage of the relatively high price difference between the money paid to the producers and the final price paid by consumers.

Environmental Impacts: Overall, though there may be localized issues, there appears to be little solid evidence of serious or widespread environmental impacts resulting from charcoal production in the Northern Province. First, in Koinadugu and Tonkolili District production is very limited, and farmers even note the benefits of increased soil carbon around kiln sites which they use as nurseries and as gardens for special vegetable production. In Bombali and Kambia Districts there are some village-level perceptions of reductions in availability of bush or woodland mature enough for efficient charcoal making, but remote sensing-based analysis suggests that impacts in these districts are modest and very localized (i.e., very small scale patches), particularly in Kambia. **As a result, it appears that the best approach would be to establish productive local-level extension-oriented relationships between Forestry Division staff and charcoal producers in these districts in order to ensure the long-term viability of this key industry.** Finally, in Port Loko

District – the heart of charcoal production in the Northern Province – there is some evidence from producers that in certain areas key tree species are becoming less available. It appears, therefore, that it would be advisable for Forestry Staff to engage in productive discussions with villages in the vicinity of Port Loko Town to devise (and encourage local support for) appropriate strategies to improve the industry and ensure its sustainability, such as planting of key native tree species and developing more efficient production methods. Support and advice from ICRAF will also be sought.

Western Area (Freetown): Although there are very small-scale charcoal vendors (selling by the plastic bag) scattered throughout the Peninsula, the Freetown interviews were limited to larger-scale vendors due to logistical constraints. The large-scale vendors interviewed generally act as wholesalers buying from the village source points and then selling on to the small-scale vendors around the city, although some do work as retailers as well. The majority of the vendors were women aged between 28 to 55 years. The main customers for charcoal are households buying for domestic cooking uses as well as some businesses in the hospitality industry (e.g., restaurants, hotels, etc.).

Recent Trends: As noted in the firewood analysis, in Freetown there has been a general trend of households increasingly shifting toward charcoal as a primary fuel instead of firewood. This in part because charcoal is perceived to be a superior and more efficient cooking fuelwood (particularly when used in conjunction with the wonder stove), but also because many landlords specifically request that tenants not use firewood in their compounds in order to reduce smoke damage and fire hazards. As a result there has been a gradual move of some firewood vendors into the charcoal vending business.

Production sites: Based on interviews with key public and private stakeholders, there are approximately 9,400 traditional charcoal kilns producing 2,232,700 bags (in 30kg) equivalent to 74.42 tonnes of charcoal in Sierra Leone (Table 9). The potential for the scaling up of new improved kilns by districts is also shown in Table 9 along with technical potential estimated at 1,520 kilns based on demand, fuelwood supplies and labour and raw materials availability. As with firewood, police do not let the charcoal trucks enter Freetown during the day, so most wait at Waterloo until late in the night before entering the city. Usually between 50 and 1,000 bags are transported per trip (depending on the size of the vehicle) at a cost of between Le 3,500 and Le 8,000 per bag (depending on the distance). Most vendors restock every couple of weeks. The supply of competitive feedstock will remain a challenge.

Chain of Custody/Fees: Apart from the income generating potential that charcoal production offers to the rural population, the producing districts stand to earn significant revenue through taxation. Charcoal vendors are supposed to pay the Freetown City Council (FCC) a business registration fee between Le 100,000 and Le 200,000 per year, though few actually pay this. Small-scale vendors (selling by the plastic bag), however, usually do have to pay Le 300 per day in market dues. At checkpoints Le 2,000 is supposed to be paid for each six bags to forestry officials but, as with the other commodities, this price is negotiable and if a ‘discount’ is negotiated no receipt is given (usually Le 30,000 to Le 60,000 per truck is paid). However, traders find means to bypass this taxation resulting in significant economic losses for the districts. Transporters often resort to taking detours through lanes and forest roads to bypass check points located on the major arterial roads.

Districts	Number of existing kilns 2013	Estimated charcoal bags (30kg) produced 2013	Estimated charcoal produced (t) 2012	Potential new kilns installation	Technical Potential Number of charcoal kiln installations
Kambia	1,000	300,000	10	120	160
Port Loko	1,000	420,000	14	120	140
Bombali	1,000	420,000	14	110	140
Tonkolili	700	120,000	4	60	130
Koinadugu	600	120,000	4	60	90
Northern	4,300	1,380,000	46	470	660

Bo	1,000	240,000	8	125	140
Moyamba	700	120,000	4	80	110
Pujehun	500	96,000	3	40	90
Bonthe	200	36,000	1	30	70
South	2,400	492,000	16	275	410
Kenema	800	144,000	4.80	100	140
Kono	500	96,000	3.20	50	90
Kailahun	700	120,000	4.00	70	90
East	2,000	360,000	12	220	320
Western Area Koya	700	700	0.02	35	130
Western	700	700	0.02	35	130
Grand total	9,400	2,232,700	74.42	1,000	1,520
<p><i>NOTE: These data are based on interviews and reports received from a major charcoal producer and seller at 91 Kissy Road (Mr. Osman Bangura), the Northern region senior forestry officer in Makeni town (Mr Mammie) and a retired Director of Forestry (Mr. Abdul-Abib Conteh).</i></p>					

1.8 Problem Analysis

Based on the above analysis of the energy situation and the current situation in industries, institutions and households that are consuming wood as fuel, the increasing trend of fuel consumption is obvious. In order to analyze the underlying causes of this problem, a stakeholders' consultation was conducted in Freetown on Mar 13-14, 2013 with 43 participants that attended the event. All main stakeholders were consulted several times during the PPG process to ensure that their priorities and experiences within the context of Sierra Leone are captured and reflected in the design of the Project. The participants generally agreed that the main problem faced by Sierra Leone regarding its biomass, fuel wood and charcoal is the unsustainable production and utilization of biomass resources (Figure 2). This situation is caused mainly by the following factors:

Policy and Regulatory Aspects:

- Lack of accurate and reliable baseline data for conducting detail cost-benefits analysis on the opportunity cost of efficient charcoal and improve cookstove solution
- Rather than seeing the unsustainable use of fuel wood as an environmental problem, there is a clear need to develop enabling environment and to sensitize all public, private and CSO stakeholders on the opportunity to develop a vibrant fuel wood and charcoal supply and demand industry as a 'stop gap' solution in accessing to modern energy services (electricity, LPG, bioethanol)
- Although the MOE has developed the National Energy Plan and National Energy Strategy (2009), the capacity and capability to translate these plans and strategies into pragmatic and business solutions remains weak at times uncoordinated and piece meal.
- There is exacerbated by weak institutional set up with high institutional memory loss and dangers of overlaps and duplications due to lack of coordination
- Lack of Centre of Excellence and platform to conduct R and D, promote and coordinate and disseminate information on alternative clean bioenergy technologies
- Furthermore, there is insufficient resources and capacity to formulate and enforce policy/regulation (e.g. Standard, Certification and Label program)
- On the supply side, there is no incentive to manage woodlands better. Likewise, lack of incentives means that appropriate tree species for fuel wood and charcoal are not planted, that management to increase yields is not applied, that techniques to improve harvesting to stimulate regrowth or easier replanting are not applied.
- Lack of recognition of the problems, the causes of the problems, make it difficult to change the currently unsustainable commercial wood energy situation. People know that forests are being destroyed, but they are not aware of legal, management, organizational and technical means to improve supply, production and utilization along the value chain.

Technical, Marketing & Finance:

- As charcoal and fuel wood prices have been constant or decreased over the last 10 years, there is little incentive to improve efficiency
- Lack of viable business and financial models with cost efficient incentives to scale up efficient charcoal and improved cookstove business
- Lack of technical and business skills to add value to the charcoal and improved cookstove supply and demand business
- Lack of access to affordable loans and credits to start or expand business
- Lack of access to alternative and affordable clean technology and fuel due to high supply and low demand risks;
- Lack of market based mechanism and value chain financing to support value chain actors
- Because prices do not reflect economic costs, there are few incentives to stimulate improved management and technical efficiency along the value chain. This feeds back to environmental effects, both in terms of the resource (trees, woodlands and forests) as well as health from inefficient combustion of firewood, in particular.
- The price of metal sheeting varies and has recently increased significantly. This is mostly due to the competition from scrap metal exporters.
- The large distance and high transport costs associated with sheet metal providers mean supply occasionally dries up.
- Access to quality clay molds is a major bottleneck in the value chain. Clay liners are poorly made and as a result break easily.
- Manufacturers do not have sufficient capital to expand production and widely report this to be a major barrier to increasing sales of improved cookstoves.
- All local manufactures are single person enterprises and most have not made any real attempt to increase production capacity to serve a larger market. Often, stove production is a supplementary income option for manufacturers.

Knowledge & Information:

- Low degree of local knowledge & expertise/capability/exposure to produce and utilize efficient charcoal and improved cookstoves solution
- Lack of Standards, Certification and Label on production and products information for end users to make informed decision on purchase (durability, user friendliness, emissions factors)
- Low level of awareness and capacity on sustainable biomass energy technologies due to lack of user friendly promotional materials and campaign strategies.
- Given the unorganized nature of the business and the complexities involved in the value-chain – from producers to the urban consumers – there is a dearth of verifiable and up-to-date information. The solutions to these problems are summarized in Figure 2 and 3.

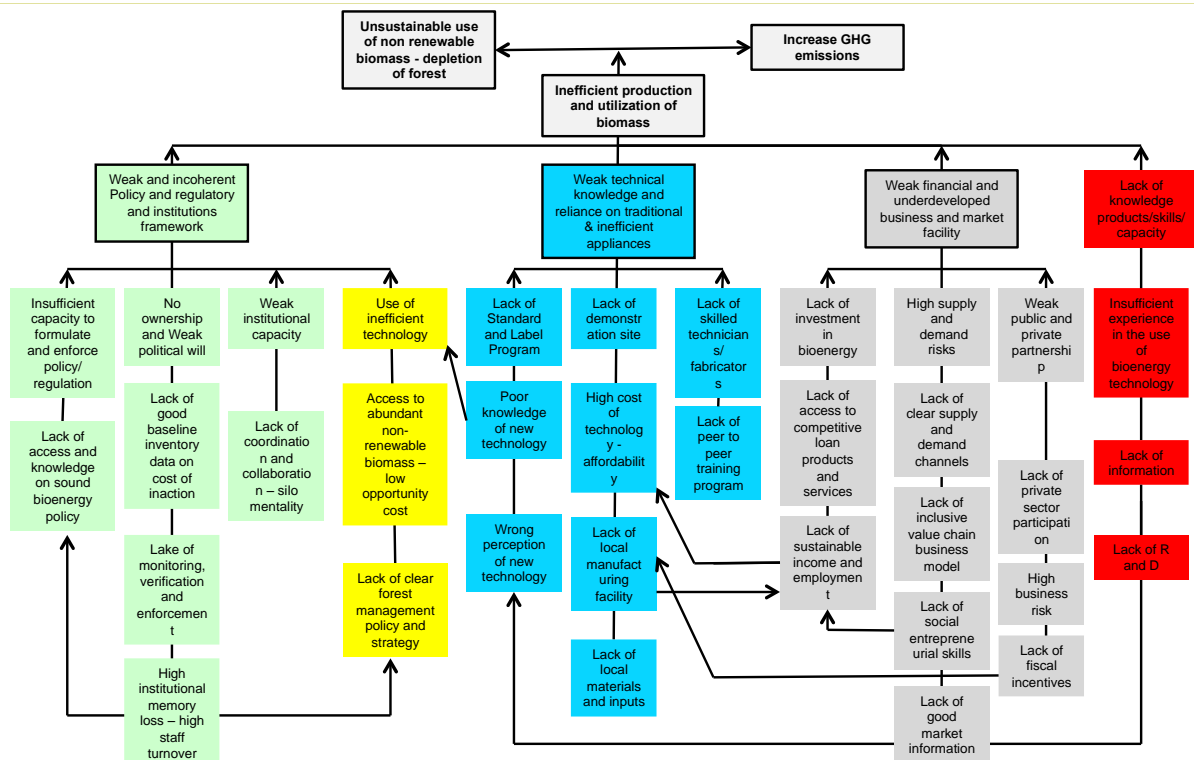


Figure 2: Problem tree

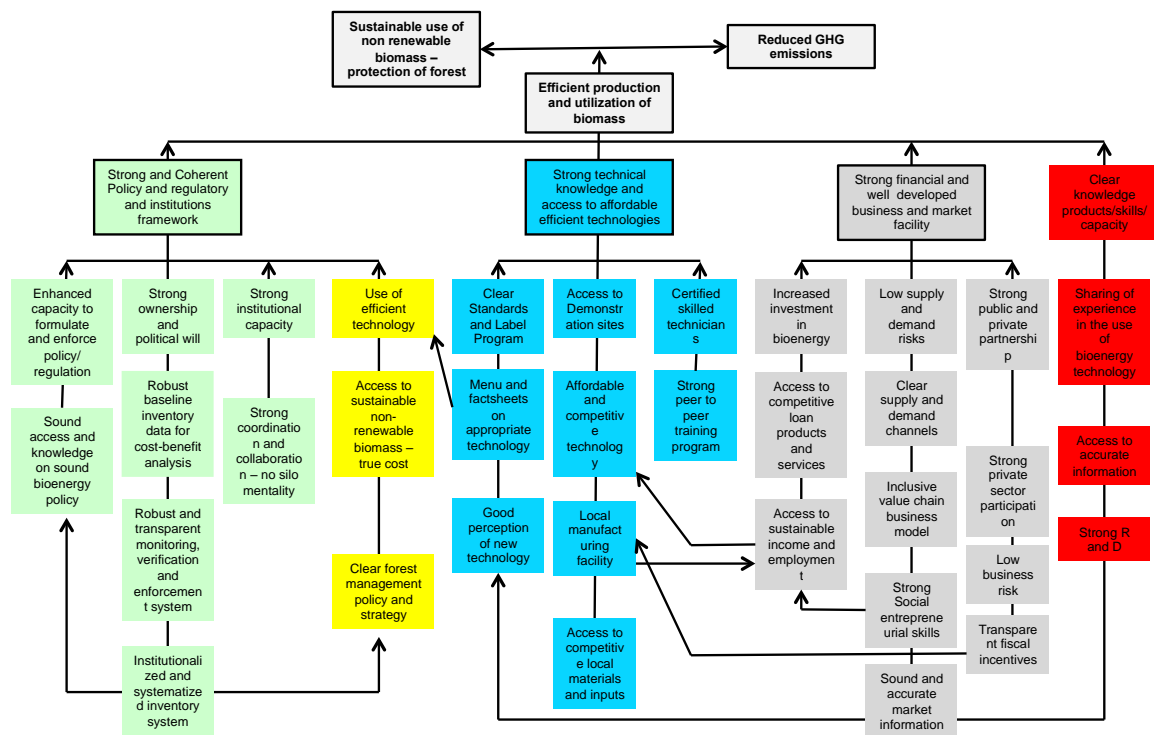


Figure 3: Solution tree

1.9 Baseline Scenario

Given the low access to modern energy services (electricity, LPG and ethanol), a large majority of the (over 90%) rural households in Sierra Leone still rely on fuelwood for cooking and thermal

energy whilst over 50% of the urban and peri urban rely on charcoal for cooking. Likewise, a large proportion of the cottage industry also uses charcoal and firewood for thermal energy such as bakery, fish smoking, tobacco curing, palm oil processing and gari production from cassava, food vendor and restaurant. High urbanization rates, the use of inefficient technologies, lack of incentives to stimulate biomass supply and reduce demand, lack technical and business skills, lack of access to alternative clean technology and the lack of regulation and enforcement put extra pressure on local forest depletion and deforestation. Additionally, the indoor air pollution caused by inefficient indoor use of fuelwood contributes to respiratory diseases, mainly among women and children and the marginalized poor.

Being one of the poorest countries in the world, governmental resources in Sierra Leone are still low, which also applies to the Ministry of Energy and Forestry Division. The solid biomass sector has not received the amount of attention it deserves based on its major role in energy provision. Moreover, the amount and quality of information available on the solid biomass sector is inadequate. In the absence of intervention, virtually all of the charcoal consumed in Sierra Leone is produced by the informal sector from wood on the basis of unimproved technologies. The informal sector is characterized by the use of traditional kilns that require no investment besides labour and there is no incentives to change. The individuals or group of individuals involved in charcoal production are not formally registered or regulated by the authorities for the production and supply of charcoal products or related services.

The unimproved technologies, also referred to as traditional technologies, used by the informal charcoal makers are earth mound kilns, pit kilns or equivalent open-end technologies solely made of branches and soil. They do not incorporate parts made of metal and/or masonry. The main problem with the baseline charcoal production is the low conversion efficiency of the wood used as both fuel and feedstock for the pyrolysis process. The efficiency of traditional kilns is 10 to 20 percent while efficiency can be increased to as high as 30 to 42 percent.

The situation in both cottage industries and households using biomass as fuel in Sierra Leone indicates that, without intervention, the current practices in the use of inefficient stoves, furnaces and traditional kilns will most likely continue, thereby continuing the trend of increased fuel wood usage, exposure to indoor air pollutions and some degree of deforestation in the country.

Presently, biomass is not used for electric power generation but mostly fuel wood is currently used in thermal applications for drying and cooking purposes in the residential, industrial and commercial/institutional sectors. A smaller amount of biomass (fuel wood) is used in agricultural sector for crop drying. Based on the Census 2010 data, a total of 3,122,589 tonnes of fuel wood was used in the residential sector (Table 4).

No formal cookstove testing have been done. But according to RE Center, initial estimate indicates that the traditional stoves in the country have efficiency of 5 to 30% for the types of stoves. Cooking at schools, prisons and hospitals still rely on inefficient traditional stove. Although some initiatives have been started in the past to introduce improved cook stoves in the country, large-scale initiatives on a national level do not currently exist. It is, thus, foreseen that a widespread dissemination of the efficient stoves in the country is not likely to happen without any form of intervention to support this objective. In the cottage industrial sector, biomass is used mainly as fuel to raise steam and heat in the production of fish smoking, gari making, salt making, bakery and tobacco curing.

Private sector development is a key engine of economic growth and crucial to reducing poverty, as underlined in the Agenda for Prosperity (2012). While the Government of Sierra Leone is committed to develop a market-led economy with the private sector as the primary engine of growth, the nascent Sierra Leonean private sector has so far been unable to spur sufficient economic development for the rapidly increased population. This is particularly evident in rural areas where poverty incidence is high and rural-to-urban migration poses a major challenge and poorer people remain excluded from the mainstream economy. An estimated one third of the population remains outside of the cash economy (formal and informal) and market access remains very limited in most rural areas of the country.

Improving the investment climate and market access provides new employment and income opportunities to both men and women. However, Private Sector Development (PSD) effectiveness

requires an understanding of the different constraints often faced by women and men in this domain. In particular, entrepreneurs and increasing women’s income offer great potential for private sector development.

This GEF funded project is well aligned with Government of Sierra Leone aspirations to mainstream gender in private sector development by ensuring that gender differences are taken into account and that businesswomen and men in Sierra Leone are able to expand opportunities to participate in, benefit from, and contribute to economic development. Women’s and men full participation in the economy will lead to improved welfare of families, communities and society as a whole.

The Project will draw lessons from and address barriers encountered by the former and existing projects like the Participatory Rural Energy Project and Second National Communication being executed by the GoSL and implemented by UNDP Sierra Leone. The project specifically aims to ensure that biomass energy use is in an efficient way and sustainable, and does not, in any way, contribute to deforestation, land degradation, reduced soil fertility or increased GHG emissions beyond project boundaries.

Figure 4 shows how with GEF support, the proposed project will remove the barriers that hinder the widespread utilization of improved cookstoves and efficient charcoal system, thereby contributing to energy savings, reduced demand for non-renewable fuel wood and GHG emission reductions. How this GEF funded project will add incremental values to the baseline initiatives is summarized in Appendix A.

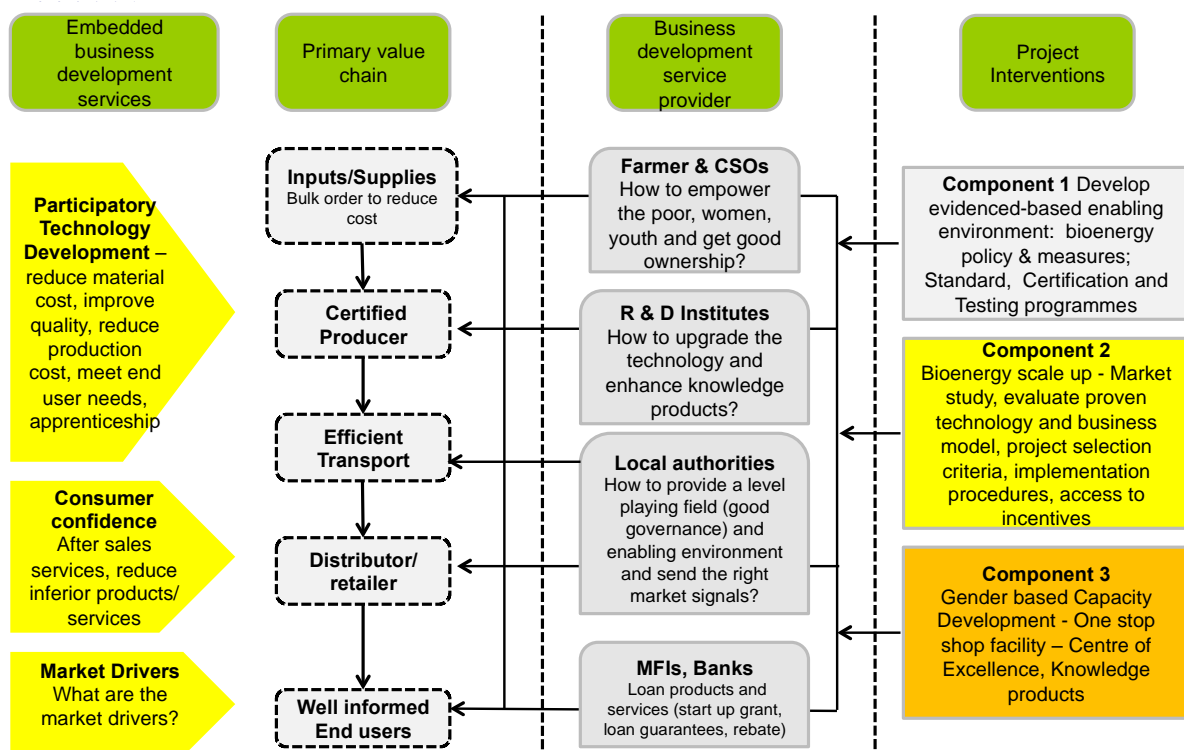


Figure 4: Rationale for intervention: Overcoming the technical, regulatory and financial barriers for the scaling up of improved cookstove and efficient charcoal production as inclusive value chain business development in Sierra Leone

1.10 Stakeholder Analysis

During the Project Identification and Preparation stages, stakeholders consisting of relevant agencies, non-Government organizations (NGOs) and private sector groups who could participate in the formulation and contribute to the successful implementation of the Project have been identified. To generate buy in and strong project ownership, participatory workshop and individual face-to-face consultations were conducted to assess their needs, identify problems and suggest solutions, clearly define their role/involvement both during the Project preparation and Project implementation and ascertain their commitment to the objectives of the Project. As these stakeholders are also beneficiaries of the Project outcomes, their participation and commitment are ensured which adds assurance to the success of the Project. A description of the public, private and CSO stakeholder groups and their involvement in the Project as well as the benefits they can expect to receive is presented in Annex B. Also a detailed description of the DOE, which will play a key role during project implementation, is also presented in that annex.

The Project Board, which is the highest level of supervision during the Project implementation, will be comprised of representatives from the funding/co-funding agencies, senior representatives of relevant Government agencies and other entities, as appropriate. This will ensure an integrated approach to deal with the challenges and opportunities that consider the interests of all stakeholders, including cross-cutting concerns/activities that incorporate and support gender equality and marginal group participation. The Project Management Unit (see Chapter 4) will be in direct regular communication with all stakeholders while exposing itself through the active participation in relevant occasions and organizing its own workshops and training seminars.

2. STRATEGY

2.1 Project Rationale and Policy Conformity

2.1.1 Alignment with National Aspirations

The **Agenda for Prosperity (AfP) – 2013-2017** will guide Sierra Leone to be an inclusive middle income country by 2035 in driving towards a low emissions, climate resilient, gender sensitive and sustainable growth trajectory. The Agenda commits to establishing inclusive development with the goals of creating opportunities for all in a fair, equitable and inclusive manner. Achieving fair and inclusive development requires extra attention to the Chiefdoms with lower living standards, so they can share in the benefits of development. This will require a reduction in the gap they face in access to basic clean energy, education, health, and infrastructure services. The current project is aligned to improve the efficient utilization of biomass for access to low emissions alternative energy (improved cookstove, kilns) through the introduction policy derisking and financial derisking instruments to create conducive and enabling environment for efficient market transformation. Thus it is geared towards a comprehensive effort to introduce and promote clean alternative energy as market based approach in Sierra Leone.

The project in line with the GEF Operational Program No. 5 is designed to remove the barriers to access to affordable alternative energy by introducing the necessary legal, institutional and regulatory frameworks for scaling up of bioenergy solutions. It is set to remove the technical barriers by providing the Government agencies, manufacturers and importers with technical assistance and a certified independent testing facility to measure the energy consumption of end-use appliances. It also addresses the informational barriers with a component to carry out outreach programs designed to sensitize the Sierra Leone populace on bioenergy and energy efficiency concepts and its potential for socio-economic development.

More also, the project is closely aligned with the Climate Change Strategic Priority Number 1 - Transformation of Markets for High Volume Products and Processes. The project is centered on a partnership between the key Government agencies, the Women and Youth groups, appliance manufacturers and importers. It is designed to transform the market for efficient appliances by introducing the total life cycle cost (purchase price operating cost) in the purchasing decisions by consumers and businesses. It is also expected to contribute to meeting the Climate Change focal area strategy and the GEF Strategic Program 1 (CC-SP1) "Promoting Energy Efficiency in residential and commercial buildings".

2.1.2 Country Ownership: Country Eligibility and Country

In 2006, Sierra Leone ratified the Kyoto Protocol. Since then, several steps have been taken to develop a national approach to tackling climate change, of which forestry is a key component. For example, in 2007 a National Adaptation Programme of Action was developed, and in 2012 a National Secretariat for Climate Change (NSCC) was established. The NSCC was tasked with developing a climate change policy, and establishing effective regulatory frameworks and procedures to support the future implementation of the Kyoto Protocol's Clean Development Mechanism (CDM) and of REDD+ projects. The promotion of REDD+ and CDM is also included in the 2009-2012 Poverty Reduction Strategy Paper (PRSP) – the 'Agenda for Change' – which identifies carbon markets as sustainable financing mechanisms to support the conservation and development of the forestry sector, including community forestry. Although concepts such as REDD+ or carbon are not yet defined in the national legal framework, a legal review for, among others, the 1988 Forestry Act was in process in 2013.

The current project was designed after extensive consultation with public and private key stakeholders, thus there is extensive inputs from the key relevant agencies of government such as the Ministry of Finance and Economic Development, Ministry of Agriculture, Forestry and Food Security, Forestry Division, EPA-SL, DOE, Ministry of Education, Science and Technology. The

project fits into the Government's overall plan to scale up alternative clean bioenergy and reduce reliance on unsustainable firewood by promoting bioenergy standards and best practices.

This GEF funded project will support Pillar 1 of the UNDAF that seeks to promote economic diversification through inclusive growth and food insecure households have improved access to decent employment and sustainable income generating opportunities. By 2018, under Pillar 2, targeted Government institutions, the private sector, and local communities manage natural resources in a more equitable and sustainable way. Under Pillar 5 private sector will be enabled to lead on accelerated generation of sustainable inclusive and decent employment whilst Pillar 8 seeks to mainstream gender equality and women's empowerment where women have greater access to political and socioeconomic opportunities and increased participation in decision making and development process in Sierra Leone.

The project is relevant to the UNDP Country Program Action Plan II (2014-2018) mandate through its strong emphasis on environmental governance, capacity development and technical training for the private sector in order to provide professionals with the necessary know-how and technical skills to advise builders and other decision makers about energy efficiency standards and to integrate them into national policies and legislations. It also fits the UNDP's mandate by helping improve the capabilities of municipal enforcement agencies leading to better governance through sustained technical and institutional support.

The EEPUC Project is fully harmonized with the priorities of the current UNDP Sierra Leone Country Programme (CPD 2009-2013). The CPD analyses recognize that strong progress was made in recent years in terms of economic growth and poverty reduction. At the same time the benefits of economic growth are not being distributed evenly, increasing inequality on the country. Poverty remains widespread in rural areas with a large proportion of the population still living a subsistence existence, providing a focus for UNDP's programming work over the coming years. The rural population and especially disadvantaged groups are recognized to be particularly vulnerable to global climatic change and recurrent natural disasters.

2.2 Design Principles and Strategic Considerations

The Project is designed to integrate a top-down approach of providing support through policy measures and demand side management (Standards, Testing and Certification), and bottom-up approach of providing financial incentives (start up grant, end user rebate and loan guarantee schemes, carbon finance) and market mechanisms to secure supply and create demand for energy efficient stoves and charcoal. To enhance the effectiveness of these approaches and to create an enabling environment among the stakeholders and value chain actors in the Project, capacity building and training activities will be conducted to enhance the technical and business capacity of the value chain actors and at the different stages of the project execution.

The selections of the cookstove and charcoal kiln technology for the provision of cooking and industrial use are based on: suitability of the technology for the identified need (user friendliness, acceptability) and opportunity for up-scaling (time and space, available skills and local materials); robustness of the design (room for improvement, standard and label); installation and operational costs (no hidden costs); cost-effectiveness (affordability, bulk order/purchase to lower cost/prices), the availability of sustainable biomass (farmer managed agroforestry for securing food and bioenergy access) and protection of the natural resources.

The goal of the Project is the reduction of GHG emissions in the domestic and industrial sectors of Sierra Leone through integrated and sustainable biomass resource production and utilization, and promotion of sustainable biomass energy technologies in Sierra Leone using output based and market based approaches.

Based on the above strategic considerations, the Project will focus on three major components as follows:

- **Component 1.** Policy and regulatory frameworks on the use of more efficiently produced charcoal and improved cook stoves

- **Component 2.** Development of public-private initiatives for the improved and more efficient production of charcoal and the scaling up of improved cookstove production
- **Component 3.** Improved, more efficient production and efficient utilization of certified charcoal and cookstove

Each of the above components will have specific activities that are designed to produce outputs leading to the following outcomes, respectively:

- **Outcome 1:** Strengthened institutional capacity on biomass resource utilization at the national, regional and community level. Operational effective policy, legal, and regulatory frameworks and review mechanisms on biomass energy technology applications
- **Outcome 2:** Increased number of investments on improved, more efficient charcoal and ICS production in Sierra Leone
- **Outcome 3:** The production and utilization of certified charcoal and certified improved cook stoves are common practices in Sierra Leone. Enhanced capacity of stakeholder in the value chain (producers, farmers, villagers, women, consumers, collectors)

2.2.1 Description of Components

Each of the four components of the Project will be managed by an agency among the Executing Partners through one overall Team Leader (see Management Arrangements in Chapter 4). There will be strong coordination among the different components to ensure synergy among the different activities and promote cost-effectiveness in the operation of the Project.

The project consists of three components that are designed to contribute toward achieving the project's objectives:

Component 1: Policy/regulatory frameworks on the use of more efficiently produced charcoal and improved cook stoves

This component seeks to overcome the policy and regulatory barriers to the scaling up of improved cookstoves and efficient charcoal kilns. Institutional and regulatory and standardization of charcoal and cookstove will be strengthened to provide consumer confidence and quality products.

The expected outcomes from Component 1 activities are: (1) Strengthened institutional capacity on biomass resource utilization at the national, regional and community level; and, (2) Operational effective policy, legal, and regulatory frameworks and review mechanisms on biomass energy technology applications. The activities that will be carried out under this project component builds on the baseline ICRAF, EU-REDD+, WAPFR, EUEI-PDF Household Cooking Energy Roadmap and other forestry projects, and the SLEPA project activities and will focus on the enforcement of policies, laws and regulations on biomass production and utilization. The capacity of decision-makers and relevant stakeholders (from EPA-SL, ministries, private sector, rural communities, etc.) will be enhanced to enable them to lead efforts, communicate and manage more efficient biomass utilization in an integrated manner. Standard, Certification and Label protocols will be developed and includes the definition of the certification criteria for more efficiently produced charcoal and improved cookstoves. Financial instruments will be developed (such as start up grant, end user rebate, loan guarantee scheme, "money box", carbon finance and microfinance products and services) for the scaling up of efficient charcoal kilns and improved cookstoves.

Component 2: Development of public-private initiatives for the improved and more efficient production of charcoal and the scaling up of improved cookstoves

This component seeks to overcome the technical and financial barriers for the scaling up of efficient certified charcoal kilns and certified improved cookstoves as public and private initiatives for the phasing out of obsolete technology. This project will focus mainly on the demand side management to reduce biomass usage and demand and will work with partners who will focus on the supply of renewable biomass through their Agroforestry programme (ICRAF, EU-REDD+, EUEI-PDF) and to leverage private sector resources (WestWind Energy, Toyola Energy, Samu, Bokarie) and build on UNDP PREP projects. Value chain analysis will be used as a framework (production, transport, marketing/sale and end user) to identify appropriate interventions for incentivizing SMEs as value

chain actors in the drive for greater efficiency. Women groups will be incentivized to create a demand pull for clean improved cookstove to reduce supply risks. This component will test, implement, evaluate and improve the financial instruments being developed under Component 1 for the scaling up of efficient charcoal kilns and improved cookstoves as sustainable business where social entrepreneurs inclusive of women and youth will be equipped with technical and business skills to partake as value chain actors. Increased investment on improved, more efficient charcoal and clean cookstove as viable inclusive business in Sierra Leone is the expected outcome in Component 2.

Component 3 - Improved and efficient production and utilization of charcoal and cookstoves

This component seeks to overcome the information barrier and low knowledge base by enhancing the capacity of the public, private and CSO stakeholders for the scaling up of efficiently produced charcoal and improved cookstoves through user friendly knowledge products (DVD, CD, training modules, marketing information, leaflets, study tour, radio, mass media) and public awareness to generate buy in and project ownership. The expected outcomes are: (1) The production and utilization of certified charcoal and certified improved cook stoves are common practices in Sierra Leone; and (2) Enhanced capacity of stakeholder in the value chain (producers, villagers, women, consumers, collectors). The requested GEF support will be mainly for the technical assistance in ensuring the efficient production of charcoal and ICS production.

2.3 Project Objective, Outcomes, Outputs and Activities

The EEPUC Project has the following Project Objective:

Project Objective: Improved and more efficient use of biomass energy resources through efficient charcoal production and improved cookstoves

The Project has been designed to implement three components that are expected to generate outcomes that, when achieved, will realize the Project Objective. The Project seeks to develop policy, technical, financial, marketing and investment de-risking instruments for the scaling up of improved cookstoves and efficient charcoal production. The key outputs include;

1. Established coherent and transparent policy and regulatory framework to stimulate bioenergy inclusive business development through demand side management (Standard, Testing, Certification and Label) and by leveraging public and private sector resources.
2. Completed pilot projects that demonstrate the commercial viability and benefits of the efficient charcoal production system derived from sustainably sourced feedstock to be used in improved cookstove.
3. Scaling up of 15,000 improved cook stoves, inclusive of 700 institutional stoves for school, prisons, hospitals and 300 industrial furnaces across Sierra Leone as inclusive business.
4. Installed 1,000 efficient charcoal kilns as public-private partnership
5. 46 improved cookstove producers and 100 charcoal producers trained, certified and equipped with technical, financial and business skills and 3,000 bioenergy champions sensitized to the biomass opportunities.
6. Established and operational Centre of Excellence for collecting, recording, disseminating and coordinating bioenergy activities and programme to strengthen the technical, resource management, financial, entrepreneurial, and social and natural capital of the public and private stakeholders
7. Established and operational Cooking Energy Development Center equipped to test and certify improved cookstove/furnaces/kilns according to international standards.
8. Established and operational local implementation structure for start up grant, end user rebate and loan guarantee scheme.
9. CBOs and women groups incentivized to create demand for bioenergy solutions to reduce supply risks.

10. Completed public education and sensitization campaigns through gender-based knowledge products to support the public and private stakeholders.
11. Completed monitoring and impact assessment of the bioenergy programme
12. A framework to phase out obsolete technologies and inefficient practices through Monitoring, Verification and Enforcement programme and by leveraging carbon finance.

To reduce Sierra Leone's energy and biomass-related CO₂ emissions the proposed project will enable the mitigation of the demand for non-renewable firewood and the access to cleaner alternative energy and renewable biomass in the country's residential, institutional and industrial sectors in the rural and peri-urban areas through the introduction of a certification and labelling scheme for new equipment and appliances.

The project has been designed to overcome the most significant barriers above and allow a faster transformation process for the market by leveraging private sector resources as part of inclusive growth. Each project component will comprise of activities that are specifically addressing a particular category of barriers. The project seeks to establish Centre of Excellence to sustain the barrier removal efforts thereby supporting the bioenergy business and market through local champions and social entrepreneurs.

Component 1. Policy and regulatory frameworks on the use of more efficiently produced charcoal and improved cook stoves

Outcome 1: Strengthened institutional capacity on biomass resource utilization at the national, regional and community level. Operational effective policy, legal, and regulatory frameworks and review mechanisms on biomass energy technology applications

This outcome seeks to overcome the policy, regulatory and institutional barriers for creating an enabling environment for the scaling up of bioenergy solutions as inclusive value chain business development by strengthening the institutional capacity on biomass resource utilization at the national, regional and community level; and operationalized effective policy, legal, and regulatory frameworks and review mechanisms on biomass energy technology applications. A strong coherent policy and strategy supported by transparent institutional, technical and financial framework will send a clear signal to investors, technology developer, service providers and producers to mobilize their resources to accelerate the market transformation to clean bioenergy solutions.

EUEI-PDF has assisted the MOE to develop the Household Cooking Energy Roadmap (2013) that is yet to be adopted and approved by the government. It recognized that biomass energy should not be viewed as an isolated sub-sector but as an integral part of the development process in Sierra Leone. The Roadmap as detailed in Annex F has recommended for the setting up of the Cooking Energy Stakeholder Group (CESG) with its first task to develop a Cooking Energy Action Plan (CEAP) in order to translate the National Energy Policy and Energy Strategy (2009) for the development of sustainable charcoal and improved cookstoves businesses. This component will support DOE, Forestry Division (FD) and in collaboration with ECREEE and GERES to set up the CESG and to develop the CEAP and to generate buy in from sensitized policymakers and lawmakers for their endorsement and support from all value chain actors. This component will develop the standards, testing and certification protocols for efficient charcoal and improved cookstoves production to be set within the framework of the National Energy Policy and Energy Strategy (2009) for Parliamentary endorsement.

Output 1.1 Adequately trained and capable decision-makers and relevant stakeholders (from EPA-SL, ministries, private sector, rural communities, etc.) leading efforts, communicating and managing more efficiently produced charcoal and improved cookstove utilization in an integrated manner

This output seeks support DOE, FD to build up awareness and educational programmes about the project and to identify best approaches to enable local participation and decision-making in all subsequent activities. In collaboration with the CESG, the capacity of decision-makers and relevant stakeholders (from MOE, SLEPA, ministries, private sector, rural communities within the CESG) will

be enhanced to enable them to lead efforts, communicate and manage more efficient biomass production and utilization in an integrated manner. The aim is to champion a vibrant biomass movement by sensitizing public, private and CSO stakeholders to the biomass opportunity and generate buy in from policymakers and lawmakers through cost benefit analysis to understand the opportunity cost of inefficient production system and to convert these environmental challenges into business opportunity for the creation of assets and capital.

Activity 1.1.1: Creation, establishment and operation of Research, Knowledge, Learning and Coordination Center (RKLCC) at DOE

Overall there needs to be better communication between lead actors within and between the forestry and energy sectors, which would be greatly facilitated by the creation of an information platform/hub and discussion forum such as a website, outreach to exchange information with forest-edge communities and increased support for the many independent producer and vendor cooperatives that could provide a productive voice for those in the trade. To overcome the lack of coordination and high institutional memory loss, a Center of Excellence will be established at DOE to consolidate, preserve, coordinate and ensure continuing use of information and knowledge that are obtained and accumulated during the capacity development and other activities in this Project. This research, knowledge, learning and coordination platform aims to develop local bioenergy champions and to support and enhance knowledge gathering and dissemination to the target audience and participants of the capacity development exercises. This platform, to be initially manned by the members of the Project Team in collaboration with DOE, Forestry Division, and Renewable Energy Center, is envisaged to act as a one-stop center and the Center of Excellence that will provide an integrated set of information and coordination services to the value chain actors and stakeholders in the biomass sector. This RKLCC will work closely with ECREEE to set up the National Cooking Energy Stakeholder Group (CESG) with the roles to (see details in Annex F): Review, modify and approve the National Household Energy Roadmap; Co-ordinate and guide the implementation of the update of the household components of the 2009 National Energy Plan and National Energy Strategy under the National Cooking Energy Action Plan; and Review progress towards achieving the recommendations in the Roadmap.

Activity 1.1.2 Preparation work and organization of training on efficient charcoal production and utilization for key stakeholders

During this preparation work, the participants from among the public, private and CSO stakeholders at the national and districts levels will be identified and selected. Invitation to the selected participants will be issued according to the protocol of the government agency involved. Along with this, other preparation work will be initiated such as: selection of the date of the training, selection and booking of the venue, invitation of resource persons, preparation of handouts and other preparatory activities.

No GEF support is required for this activity.

Activity 1.1.3 Conduct of training on efficient charcoal production and utilization for key stakeholders

Annual training will be conducted by an external expert to be sourced through Technical Assistance. The training will provide technical and commercial knowledge on different aspects for the scaling up of sustainable charcoal production and utilization and improved cookstoves as outlines under the Cooking Energy Action Plan (to be developed under Output 1.2). Issues to be covered are: how national policy and regulations, what skills, techniques and technologies are available to support sustainable charcoal and cookstove businesses; how to raise awareness and develop educational program on local ordinances, guidelines, standards and certification for sustainable charcoal in all targeted pilot districts; the livelihood and economic aspects of charcoal production and the ecological effects; to understand the important contribution biomass energy makes and will continue to make for many years, and the need to put in place the institutional and financial supports to make it as sustainable as possible; to understand how existing policy framework in forestry, local government, and lands will permit and support the development of sustainable local biomass energy activities, particularly setting up commercial biomass energy enterprises; it is important to raise the awareness of the general public on issues of, and opportunities for, improved forest management for biomass energy, improved efficiency of harvesting and of charcoal and/or firewood transformation, on the

supply side, and efficiency of use and demand management, on the demand side. It is key to tackle both supply and demand simultaneously with the aim to slowing down the process of forest and woodland degradation and deforestation.

The resource person who will conduct the training will be selected through a competitive tender for a TA. This training will be conducted every year during the Project implementation. Funds from GEF are necessary for financing the TA to conduct training on sustainable charcoal production and utilization, as well as organizational costs of the training and production of handouts

Activity 1.1.4: Generating public sector buy in through advocacy on project impact and co-benefits analysis

To overcome the difficulty of negotiation among competing priorities and the slow funding from the central government for implementation, this activity will support the CESC, Ministry of Finance and Economic Development and Ministry of Trade and Industry to utilize the decision making tools developed to generate strong buy in from sensitized public stakeholders (policymakers, lawmakers, planners at the national and Chiefdom level) by: i) engaging early on in a dialogue with the key public decision makers and financiers at the local and at the national level, starting from Q1 of Year 1; (ii) develop robust economic and social (including health and environmental) analysis of the co-benefits and expected impact of the proposed activities, reforms and mechanisms to feed this dialogue; and (iii) enable a comparison between what the project proposes and the other competing priorities authorities are considering. This will ensure that appropriate national budgets are ring-fenced for targeted access to clean cookstove technology, at the household, institutional and industrial levels. The support will also include an analysis of the scope of work of the envisioned baseline database to be developed by GERES, matching the expected financing (including beyond project completion) with targeted data, data access modes and updating periods that are in line with the key demands of the targeted users. The focus will be on implementation going beyond analysis so that there will be appropriate matching of financing for the widespread dissemination and application of these clean bioenergy technologies. The Ministry of Finance & Economic Development and the Ministry of Trade and Industry will serve as key members of the Project Board for early dialogue, involvement and support.

Output 1.2. Formulated, approved and enforced policies, laws and regulations on more efficient charcoal and improved cookstoves production

The key role of policies is to create an enabling market environment for the promotion of sustainable charcoal and improved cookstoves businesses in Sierra Leone. The set of policies/Government-supported programmes proposed must be designed to gradually change the charcoal and cookstoves value chain, influence consumer behavior and increasing the demand for sustainable charcoal and efficient cookstove. As the market gradually transforms, it will provide individuals in the value chain opportunities to adapt and respond to the evolving market scenario.

In order to build the confidence of the value chain actors (investors, producers, end user) through the promotion and marketing of efficient charcoal and improved cookstove products and services, a policy regulatory framework to support a standard, testing and certification (STC) program will be pursued. The program will be developed in collaboration with GERES, DOE, FD and Renewable Energy Center (REC) at Freetown where cookstove and charcoal testing and certification facility will be installed. The standards will form the basis of the production method, testing protocol and promotional communications. National and international experts will advise on setting the right technical standards and norms for meeting local needs.

The Stove Performance Inventory report¹⁰ has mapped and compared stove performance against standards or benchmarks, the most relevant of which is the recently approved ISO International Workshop Agreement (IWA) on Clean and Efficient Cookstoves (February 2012). The IWA, which is

¹⁰ Stove Performance Inventory Report (Oct 2012) Prepared by Berkeley Air Monitoring Group for the Global Alliance for Clean Cookstoves United Nations Foundation.

a preliminary step towards a formal ISO standard (ISO 285), uses “Tiers of Performance” to categorize stove performance levels for efficiency, safety, and emissions.

This Output will provide support to the MOE and Forestry Division and CESG to develop the Cooking Energy Action Plan. The team will provide technical advice for implementation and advocacy activities, as well as M&E support for the Cooking Energy Action Plan. User interest, behavior and feedback will be also be emphasized to provide feedback to the CEAP. The framework will set the guiding principles and action plan for bioenergy development and promotion, based on the guidance of the National Energy Policy and Energy Strategy (2009) and, at the same time, ensuring consistency and synergy with the implementation of the Forestry Act. The CEAP will form the GoSL’s strategy for the promotion of bioenergy on the supply and demand side in Sierra Leone. Due to the wide range of stakeholders, a participatory approach is considered appropriate to reach consensus between them.

Activity 1.2.1: Stakeholder consultations to define and formulate the Cooking Energy Action Plan

In order to ensure participatory, demand led and country driven initiative, public, private and CSO stakeholders consultation at the national and local levels will be conducted in collaboration with CESG and DOE, FD to define and formulate the CEAP. The CEAP should capture the broad and strategic issues related to sustainable charcoal production and utilization and improved cookstove in Sierra Leone, and devise practical measures to encourage, promote and support widespread dissemination of modern, efficient and affordable and certified cooking energy applications. The consultations will also discuss the different inclusive roles of youth, women and men in the production and utilization of biomass and the new technologies and how the role of women can be enhanced in the project. Guided by the strategic guidelines as agreed by the stakeholders, the Project team with support from external Experts will prepare a detailed Cooking Energy Action Plan to cover on programmes, standard, economic, environmental and market mechanisms for the biomass energy sector in driving towards a low emissions, climate resilient and gender sensitive and sustainable development trajectory for Sierra Leone.

Activity 1.2.2: Support the Government approval process of Cooking Energy Action Plan for sustainable charcoal production and utilization and improved cookstoves

The GEF Project’s Bioenergy Policy Experts will support DOE, FD and CESG to define the strategies for the CEAP to be approved by the Council of Ministers/Government and their subsequent implementation. Negotiations with Parliamentarians for their support to seek Government approval will be critical and the Project will accordingly work closely with them promoting and publicizing, as well as seeking the necessary social acceptance of the CEAP. While the GoSL and its partners will focus on the baseline activity of engaging stakeholders at the ground level in the districts and villages, the GEF Project will focus on engaging with stakeholders at the national level. Implications on cross-cutting issues such as gender, social inclusion and poverty reduction will be analyzed and an action plan developed and implemented. The project team will also work closely with the Community Forestry and Commercial Forestry Division of the Forestry Division to support the alignment of policies and regulatory frameworks and institutional capacity for the adoption of sustainable practices on the production of sustainable biomass for energy generation. This will involve working closely with local community based organizations (CBOs) that are active in promoting agro-forestry and watershed management program e.g. ICRAF, EU, CARE, BioClimate.

Activity 1.2.3: Roll-out of the Cooking Energy Action Plan for implementation and promotion of sustainable charcoal and improved cookstoves businesses

The Project team will work closely with DOE, CESC, FD, CBOS, ICRAF, GERES in the implementation of the CEAP, continuously guiding the monitoring and evaluation of the plan as they are rolled-out and assess the prospect for upgrading based on lessons learned.

Activity 1.2.4: Preparation of detailed regulatory frameworks, containing regulations, procedures, standards and incentives for the smooth and effective implementation of biomass energy applications

This activity will ensure that the standards, testing and certification program development and implementation will be set within the framework of the National Energy Policy and Energy Strategy (2009). During this activity, support will be provided to get the National Energy Policy endorsed so that the SCT programme will take on a legal status. Support to the MOE, including advocacy activities to generate buy-in for the approval and implementation of these policies and legislations will be conducted within this activity. The implementation of these policy instruments will be monitored and, where appropriate, support will be provided from project team to make the implementation more effective.

Working closely with GERES and Renewable Energy Center, the standards for equipment, production method, testing protocol, performance matrix, and promotional communications will be developed under Output 1.3 according to international protocols such as the ISO IWA on Clean and Efficient Cookstoves (Feb 2012) standard. To remain viable, a testing system based on chargeable fees will be developed. The standard and label will form part of the criteria for the implementation and eligibility to the startup and end user rebate scheme.

Output 1.3 Developed standards and certification protocols for efficient charcoal and improved cookstove

Standards and Labels are regulatory tools that increase the average energy efficiency of individual product classes. They contribute to the phasing out of the least efficient products in a market by setting the minimum levels of energy efficiency that a product in a given class must meet before it can be sold. S and L provide the most cost-effective policy option for phasing out inefficient cooking and other appliances and replacing them with more energy efficient options. When effectively applied, S and L, in conjunction with supporting policies, encourage manufacturers to improve the efficiency of their products or to introduce more efficient replacements. Before S and L are adopted, cost/benefit analyses must be performed to ensure that the associated rules and regulations provide a positive economic benefit to the nation or market that implements them. S and L should be developed in consultation with all of the stakeholders involved in the manufacture and sale of the products to which they apply.

Guided by the Policy framework developed under Output 1.2 above for the development of the standard and certification programmes, a Cookstove and Charcoal Development Center (CCDC) will be set up in Sierra Leone. In partnership with GERES and ECREEE, the Sierra Leone CCDC will play a number of key roles in supporting improved cookstove and charcoal kiln activities in the country. The standards for equipment, production method, testing protocol, performance matrix, and promotional communications will be developed according to international protocols such as the ISO IWA on Clean and Efficient Cookstoves (Feb 2012) standard. To remain viable, a testing system based on chargeable fees will be developed.

While data on the performance of technologies and fuels is critically important to the sector's progress, an equally important parallel relates to understanding user behaviors and stove adoption, which will be critical for achieving the maximum benefits from clean cook stoves technologies in Sierra Leone. This will avoid the 'one size fit all' mentality. Activities will seek to understand the adoption parameters, kitchen management and "stove stacking" across the 13 districts and develop common definitions, methods, and metrics for adoption, usage, acceptance, and uptake. These will

form a critical feedback to CCDC in setting appropriate standards applicable to Sierra Leone. The activities will set benchmarks and highlight best practice for implementers to ensure successful adoption and appropriate usage.

Using state-of-the-art equipment, the CCDC will provide charcoal and wood stove testing services for NGOs, private sector producers and government. It will undertake research into stove and kiln design and production, both to improve existing stove and kiln designs and explore alternative designs that will be appropriate for Sierra Leone. It will act as a resource center and training institute, disseminating knowledge and skills to a wide variety of cookstove and charcoal actors.

The focus of the CCDC for the proposed programme will be biomass cookstoves and charcoal kiln, as at present there is limited scope in Sierra Leone to make the leap to other cleaner technologies such as LPG or ethanol or biogas. In subsequent years research and design support for these technologies will also be included.

Activity 1.3.1 Select institution in which the CCDC will be located

The CCDC will be located in Freetown and established in a prominent learning institution to be selected on approval of the proposed programme. The selection process will be rigorous and transparent, and criteria for selection will include: i) Reputation and profile of the institution; ii) Research capacity and experience; iii) Training capacity and experience, including for external actors; iv) Interest and commitment of senior leadership towards alternative energy and cookstoves; v) Financial contribution and commitment to long-term presence of the CCDC; vi) Skills and enthusiasm of identified staff for the CCDC; vii) Accessibility to cookstove and charcoal actors and stakeholders.

The selection process for the CCDC will be led by project team, but conducted in consultation with key government actors. Based on preliminary assessments, potential institutions include Renewable Energy Center and Faculty of Engineering of the National University of Njala. Once selected, the project team will sign a MoU with the chosen institution outlining in detail roles and responsibilities, and will support the institution to formally integrate the CCDC into its structure.

Activity 1.3.2 Organize 4 weeks training for staff from the CCDC (and other supporting institutions) at Aprovecho Research Centre (ARC)-accredited labs in Nigeria or Senegal

The four-week intensive training will be held in ARC-accredited laboratories in either Nigeria or Senegal (to be finalized during project implementation). Holding the training at ARC-accredited labs will allow trainees to be fully immersed in cookstoves, avoiding distractions from other day-to-day responsibilities, and enabling them to benefit from teaching by a number of different stove experts and trainers.

On approval of the programme, the project team will work with ARC-accredited labs to finalize the training schedule and materials to act as a reference guide for the CCDC. The table below summarizes the training topics that will be covered:

Module	Sub-topics
Introduction to clean cookstoves	History of cookstoves and programmes; Indoor Air Pollution and cookstove benefits; Fuel-efficiency; Emissions;
Principles of cookstove design	History and development of design principles
Testing efficiency and emissions	Water-boiling Tests and Controlled cooking tests; Using the emissions hood
Stove designs	Kenyan Stove; Rocket stoves; Fan-assisted gasifier stoves; Clay/Mud-based stoves;
Stove production	Metal-working; Cement casting; Mud stoves
Market-based approaches	Design considerations; quality assurance; after sales services; distribution channels

At the end of the training, participants will be formally assessed on all aspects of cookstove testing and design. Those that pass will receive certification as cookstove technicians, and for those that don't, the assessment will help to identify areas that still need further training (to be conducted under activity 1.3). Two staff members from the CCDC will attend the training at ARC-accredited labs in Nigeria or Senegal.

GEF fund is needed to finance for the training.

Activity 1.3.3 Set-up cookstove testing laboratory in CCDC

Following the training, one ARC-accredited stove technician from Nigeria or Senegal will accompany the training participants back to Sierra Leone, and support them to set-up the testing laboratory within the CCDC. The space for the testing laboratory will be provided by the host institution, though small improvements may be required including painting, office equipment (desks and chairs) and ventilation work. The testing equipment will consist of the following: Portable Emissions Monitoring System with Gravimetric PM analysis (PEMS); Indoor Air Pollution Meters; Laptop computer, Scales, Digital and Analog Thermometer; Moisture Meter; Small oven; and other small items such as metal trays, gloves, pots and tongs.

GEF fund is needed to finance the setting up of the labs.

Activity 1.3.4 Develop standard from fuel-efficiency and emissions testing of all existing cookstoves in Sierra Leone

None of the cookstoves currently being produced and promoted in Sierra Leone have ever been tested for fuel-efficiency and emissions according to international best practice. Research into the efficacy of current Sierra Leone stoves is therefore a priority for the CCDC to develop standard.

CCDC will be supported to conduct efficiency tests on at least 10 charcoal and wood stoves in the country, including the clay stoves being made by micro-businesses in Freetown, the hybrid rocket stove design, the permanent household stoves being installed by local NGOs and WFP, and the clay and metal stoves being produced by a local NGO. This 'baseline' testing of current stoves will be part of the learning process for the CCDC, and the testing process may also collaborate with testing labs in Nigeria and Senegal under the guidance of ARC. After testing, three more energy efficient prototypes will be selected for scaling up. Under the business model to be developed by the CCDC, fees are unlikely to be charged for this initial testing phase of current cookstoves. But a fee charging system will be developed to cover for costs for commercial testing.

Activity 1.3.5 Facilitate iterative design improvements and strategic new stove designs by the CCDC

The research into the efficiency of current cookstoves will provide the basis for this activity. Based on their training at ARC-accredited labs in Nigeria or Senegal and using Participatory Technology Development approach, the CCDC staff will evaluate how existing stove designs can be adapted to improve their efficiency and emissions, and also to make them more appropriate for large-scale take-up. CCDC staff will work on design improvements in an iterative process, with testing conducted after each iteration to accurately test the impact.

The CCDC will also conduct research into alternative stove designs (e.g. gasifier) that have not yet been tried in Sierra Leone. These designs will be adapted to the local context using stove designs that have been successful in other countries. The CCDC's interaction with other stove development centers including ARC, and with the GACC, will be an important channel for ideas.

Component 2. Development of public-private initiatives for the improved and more efficient production of charcoal and the scaling up of improved cookstove production

Outcome 2: Increased number of investments on improved, more efficient charcoal and improved cookstove production in Sierra Leone

This outcome seeks to overcome the lack of demand, market infrastructure and demonstration sites in Sierra Leone to showcase proven commercially viable bioenergy technology as inclusive business where the poor and women can be empowered to participate as producers, suppliers, distributors, employees or well-informed end users. This will help to strengthen the technical, resource management, financial capitals and business acumen of the poor. Participatory technology development will be used to ensure that the networks and cooperation of the designers, developers, producers and end users along the value chain could be strengthened to work together so that the products meet end user needs and avoid a 'one size fits all' paradigm.

Such inclusive business model will ensure that hard works, productivity and innovation can be translated into rewards and tangible assets. Cooperation and sharing of ideas will be promoted to strengthen the social capitals through peer-to-peer learning and help mobilized local resources. The ultimate aim is to develop local social entrepreneur and champions who are technically, financially, environmentally and socially capable of designing, deploying, diffusing and accelerating the market transformation to clean bioenergy solutions. This outcome also seeks to overcome the lack of access to capital, microcredits and affordable and pro-poor financial products and services where bioenergy solutions could be used as an engine for growth, local innovation and employment. Social marketing and social banking (micro-venture, incubation) and innovative financial models will be tested.

As an alternative to the ever dwindling and limited public, bilateral and multilateral fundings, efforts will be made to explore the opportunity to phase out obsolete technologies by monetizing the environmental services into tangible carbon credits for voluntary or compliance market as programmatic CDM¹¹ or Nationally Appropriate Mitigation Activities (NAMA) and to leverage green climate funding and to market and brand Sierra Leone as an LDC country. This will help to identify the gaps, need and challenges of the Designated National Authority (DNA) in the country. In collaboration with GERES, Standardized Baseline data will be established so that project and future GHG emission could be quantified and developed as carbon project.

Output 2.1 Established partnerships between the public and private stakeholders involved in the value chain of charcoal production and utilization

Activity 2.1.1: Inventory and assessment of relevant community-based organizations

The community-based organizations (CBOs) are key entities in the implementation of the roll-out mechanism to disseminate up to 15,000 stoves and 1,000 kilns targeted in this Project. The establishments of these organizations are still emerging in Sierra Leone and the ones that currently exist have limited geographical and sectoral coverage. During the PPG stage, the CBOs such as the Women Group, Toyola Energy, EFP, World Vision, Concerns International, WFP and the Community Forest Management Group and local NGOs (EFO) and private enterprise (WestWind Energy, Toyola Energy, SAMU, Bockarie) were identified. During the project implementation, a systematic and detailed assessment of these organizations, particularly those that have presence in the target districts will be conducted to assess their strength and capacity to participate in this Project. The inventory and assessment of relevant CBOs will also include an assessment of their experience in providing equal opportunities to both men and women individually or collectively. Where possible, dialogues will be held with existing women's organizations operating for other sectors or purposes to investigate opportunities for incorporating the promotion and delivery of improved cook stoves in their existing activities.

GEF support is required for local transportation, accommodation and per diem costs of the EEPUC Project personnel to assess and discuss with CBOs.

Activity 2.1.2: Identification of roles of community-based organizations and agreement on modalities and incentives for their participation

From the assessment conducted in the previous activity, agreements will be made with the most relevant and suitable entities. The agreement will define the roles and responsibilities of these CBOs, the modalities and incentives for their participation and funding requirements. A business and

¹¹ Carbon credits generated from the project could be sold for the voluntary or compliance market.

financial models and tentative procedures for the roll-out of the improved stoves and efficient charcoal kilns using the CBOs is described in more details in Appendix B.

GEF support is necessary for local transportation, accommodation and per diem costs of the EEPUC Project personnel to agree on modalities with CBOs.

Output 2.2 Developed incentives through carbon finance, microfinance, rebate and loan guarantee schemes to scale up sustainable charcoal and improved cookstove businesses

This output seeks to overcome the financial barriers by leveraging private sector resources for the scaling up of efficient charcoal kilns and improved cookstove business where the poor can be empowered to participate as actors in the value chain. Value chain financial products and services will be developed for the efficient utilization of biomass for bioenergy and food security solutions.

This output will review local, national, regional and international lessons learned in the scaling up of bioenergy solutions as inclusive business and value chain financing. Activity will help to design, adapt, adopt and recommend proven and tested fiscal, economic and value chain incentives that will reward hard work, productivity and innovation. Strategies to leverage private sector resources through carbon finance and microfinance to champion bioenergy business development will be developed. The roles of fiscal incentives (tax holiday, import tax waiver, rebate/coupon, start up grant, end user rebate) for the scaling up of bioenergy in Sierra Leone will be reviewed and assessed and adopted.

In an effort to reach its target of providing clean cookstoves to 20 million households by 2020, the GACC has launched the first carbon finance loan fund to attract private sector money. It has formed a partnership with the Gold Standard Foundation and the Nexus Carbon for Development and this output will explore opportunity to leverage these carbon finance loans¹². This project will support SLEPA (Designated National Authority) to assess the feasibility to access this fund. Other funds have also been set up to improve capacity and working capital of the entrepreneurs¹³.

Activity 2.2.1: Reviewed lessons learnt in the financing and scaling up of sustainable charcoal and improved cookstoves business

During the preparation of the Project, an investigation of the financing mechanisms of similar programs as the EEPUC in Sierra Leone as well as other countries was conducted. It was found that technology led and input-based approach can be ineffective and inefficient in delivering public goods and services and appliances given free often do not instill ownership. During the Project implementation, a more thorough assessment will be made to cover financing schemes that could be applicable to a broader menu of cookstove and charcoal kiln applications. The study will also include incentives provided by other governments in their respective countries (or through partnerships with donors) and their effectiveness (particularly in LDCs with small population, where market is supported successfully, like Nepal, Sri Lanka, Bangladesh, Mongolia, etc.), with the view of making appropriate recommendations to the responsible ministries within the GoSL on the possible incentives that could be given to project involving the production and use of biomass energy. Incentives will be sought from the Government for other activities that will promote the production of sustainable biomass and use of biomass residues for energy generation in industries. The financing schemes and incentives that have been successfully introduced in some countries include: start up grants, end user rebate, full or partial loan guarantees, output/outcome based finance using voucher/coupon scheme, social banking (micro-venture, micro incubator, social impact bond), soft loans, support on micro-financing, carbon and climate finance, tax holiday, import tax waiver, indirect rebates such as providing market sectorial mapping, consumer focus group mapping etc. In addition, in partnership with ICRAF and EU-REDD+, incentives will also be explored will promote the production of sustainable biomass (environmental services payment) and use of biomass residues.

GEF fund is needed for financing a TA to study potential financing schemes.

¹² GACC's Carbon Loan Fund: <http://carbonfinanceforcookstoves.org/clean-cooking-loan-fund-application>

¹³ GACC's Enterprise Capacity Development Fund:

<https://cleancookstoves.competition.bidx.net/en/page/capacity-building>; Working Capital Fund: <https://cleancookstoves.competition.bidx.net/en/page/working-capital>

Activity 2.2.2: Establishment of procedures, implementing arrangement, oversight and modalities for the implementation of startup grant, end user rebate and loan guarantee scheme

The EEPUC Project will work closely with DOE, the Ministry of Finance, UNDP's Social Business programme and MFIs to establish the procedures and modalities for the implementation of financing schemes such as startup grant and end user rebate that will be decided as appropriate for the context and situation in Sierra Leone. For instance, during Project implementation, voucher scheme for the production (Supply contract) and marketing (Demand contract) of stoves will be provided to the producers and end-users that need some rebate. Peri and urban end users will not require end user rebate. Given that the upfront cost for cookstove production is high, two start-up grant schemes using quasi-experimental design will be developed to be tested and improved under Output 2.5 to cover upfront cost of the production with gradual reduction towards the end of the Project. In this activity, a mechanism will be worked out for the Government to provide a rebate scheme that will encourage the end-users to continue using the cookstoves and replicate its use throughout the country. In addition, in partnership with ICRAF and EU-REDD+, incentives will also be explored will promote the production of sustainable biomass (environmental services payment) and use of biomass residues.

GEF support is required for TA to establish procedures and modalities. GEF fund is needed only for meeting costs.

Activity 2.2.3 Design and implementation of the loan risk guarantee scheme (LRGS) funding for entrepreneurs in the stoves/furnaces/kilns value chain business

Building on the work and experience of MFIs (e.g. BRAC) in Sierra Leone, the GEF project will work closely with MFI and UNDP Social Business Programme and its partners to incorporate a targeted initiative to implement a loan risk guarantee scheme for entrepreneurs willing to participate in stove/furnace/kilns manufacturing and its value chain business as detailed in Annex C. During Year 1 of the project, the GEF Project team and the UNDP Social Business and MFI Project team will collaborate to design and detail the financial mechanisms to be put in place; identify and seal agreements with the lead bank, appropriate intermediary financial institutions, if necessary, and the stoves/furnaces/kilns entrepreneurs; and detail activities necessary to sustain the means (financial in particular) for the mechanism continuation and scaling-up beyond project completion. During Year 4, the Project will prioritize an exit strategy where a sustainable follow-up plan will be prepared (e.g. revolving fund, Trust fund) in order to continue the LRGS beyond the project-life to attract public/private sector.

Activity 2.2.4: Implementation of financing schemes and incentives for demonstrated kilns and cookstoves applications & services

The financing schemes and incentives that will be established in Activity 2.2.2 may be implemented through a government agency or a non-government entity such as a financing institution. In many instances, there exists a big gap between regulations and their implementation, thus giving rise to ineffectiveness of the regulation with high transaction, operation cost and risks. This activity will promote close coordination with participating institutions and a commitment from the GoSL to allocate resources and provide the approved incentives. Support mechanisms and infrastructures to encourage uptake of the incentives will be initiated such as: assisting implementing agencies in streamlining procedures; reducing transaction cost; organizing campaigns to create awareness of the incentives and how to tap them; supporting potential end-users in preparing applications an business plan; monitoring and evaluating effectiveness of incentives; avoidance of perverse incentives, etc.

Output 2.3: Implemented and operational i) 300 locally produced industrial stoves for income generating local enterprises such as fish smoking, bakery, palm oil processing and tobacco curing and ii) 700 institutional stoves for school, prisons and hospitals.

This output seeks to build on the success of the manufacturers of household cookstoves under output 2.5, to green up the cottage industry and institutional cooking value chain by generating

market driven supply of industrial / institutional cookstoves/furnaces/kilns to create a cleaner, safer, more hygienic working conditions whilst creating green jobs. In the private sector, the need for improved efficient cooking technologies is largely in the major urban areas of Freetown and the larger district capitals, and is seen in catering businesses, food processing (e.g. fish smoking, salt making, bakery, tobacco curing) and some light manufacturing enterprises such as ceramics and brick making. In the public sector there is also much need for institutional stoves in schools, hostels, prisons and hospitals.

Production of these stoves is likely to be centralized, with businesses constructing/installing the stove on the premises of the consumer. The stoves will be constructed from local materials using rocket-design for large pots or energy efficient ovens. This output will work closely with UNDP's Social Business programme in developing mentoring and business incubator programmes in greening up the value chain.

Activity 2.3.1: Identification of local producers/fabricators, raw material suppliers and micro-entrepreneurs and their specific areas of involvement

During PPG, value chain analysis have been conducted to identify fabricators, business services providers and micro-entrepreneurs that have the capability to locally produce parts of cookstove and kiln for demonstration projects. This list will be expanded to cover districts where fabricators have not been identified. While expanding the list of fabricators, a screening and selection of the most suitable fabricators/entrepreneurs will be conducted. These will be offered in partnerships with UNDP Social Business Programme and BRAC in the investment, production and delivery of cookstove and kilns to be promoted in this Project.

The GEF support is needed for local transportation, accommodation and per diem costs of partners personnel to screen and select suitable fabricators and entrepreneurs.

Activity 2.3.2: Investigation and formulation of appropriate procurement procedures, cost sharing schemes and market delivery mechanisms

After the private sector participants are mapped out and their potential roles ascertained, the project team along with UNDP's Social Business programme and government team will formulate a framework for partnership between DOE and the entrepreneurs that is workable, effective and provides benefits and incentives to all parties concerned. This will entail detailed discussions with all parties concerned and the possibility to use tested models and innovative output based schemes as appropriate. Support mechanisms in the form of capacity development and/or financing incentives to micro-entrepreneurs will be agreed as part of the public-private partnerships that will be created. Such mechanisms will be made in synergy with other activities in this Project.

Activity 2.3.3: Implementation of public-private partnerships for the production & delivery of energy efficient stoves/furnaces/kilns

The implementation of the public-private partnerships formulated in Activity 2.2.2 will be the bases for the implementation and dissemination of stove/furnaces/kilns in the relevant industries targeted in this Project, namely the fish smoking, gari making, tobacco curing, bakeries and ceramic making sectors. The aim is for private enterprises to take up roles in the project cycle that are best done by the private sector and eventually doing it through normal market mechanisms without any government intervention or support.

GEF support is needed for local transportation, accommodation and per diem costs of partners personnel to meet with the private sector and establish public-private partnerships.

Output 2.4: Implemented and operational 1,000 locally produced efficient kilns for the sustainable production of charcoal.

Whilst ICRAF and EU-REDD+ programmes focus on the supply side, in partnership with FD and Charcoal Producers Association and local Chiefdom, this output will focus on demand side management to improve charcoal production efficiency and align the interests of all value chain actors for ensuring commercially viable production of certified charcoal on a sustainable basis.

This output will work closely FD (under the ICRAF, EU-REDD+), local Chiefdom, Charcoal Producers Association, and UNDP Social Business, MFI to develop enterprise to test business model and incentives for sustainable charcoal production, whereby producers will have access to, and management of, forest land. This project will focus on developing the charcoal kilns technology with businesses constructing/installing the kiln on the site of the charcoal producers. The kilns will be constructed from local materials using retort design. Technical and business training will be provided for charcoal producers in best practices during the charcoal production process and in assembly and management of portable metallic kilns and modified earth kiln. Charcoal Production Manual developed under output 3.2 illustrating best practices during the charcoal production process will be disseminated. This output will work closely with UNDP's Social Business programme in developing mentoring and business incubator programmes in greening up the value chain. In partnership with MFIs and MFED, the startup grant and loan guarantee scheme will be tested, evaluated, and upgraded during project implementation.

As part of the piloting process of the improved charcoal technologies, groups of selected farmers and leaders from the ICRAF and EU-REDD+ will be chosen with the help of the District Forest Officers. They are then trained in improved methods of charcoal production. The purpose of piloting and training in the charcoal production technologies is to achieve the following objectives:

- i. To be part of the sensitization process of the possibilities for improved charcoal production and improved incomes from charcoal-making.
- ii. To select in a participatory manner the most appropriate charcoal conversion technology for the target groups.
- iii. To identify areas of improvement in the designs to address issues of operations and cost.
- iv. To test whether the skills and methods for improved charcoal production could be retained and appropriately applied by the trained groups.

Activity 2.4.1: Identification of local producers/masons, raw material suppliers and micro-entrepreneurs and their specific areas of involvement

Initial value chain analysis has identified mason, business services providers and micro-entrepreneurs that have the capability to locally install kilns for the scaling up projects. In partnership with DOE, FD under the ICRAF (University of Eastern Finland) and EU-REDD+ programmes, this list will be expanded to cover districts where fabricators have not been identified. Ranking criteria for categorizing types of charcoal producers or entrepreneurs with specific focus on ensuring gender equity among groups will be developed. Surveys to rank different actors into pre-determined categories based on capacity analyses and technology needs will be conducted. These will be offered in partnerships with UNDP's Social Business Programme in the investment, technical and business training and installation of kilns to be scaled up in this Project. 100 sustainable charcoal producers will be organized, trained, certified and operational and comprised of a minimum 3,000 charcoal champions spread across pilot districts.

The GEF support is needed for training, local transportation, accommodation and per diem costs of partners personnel to screen and select suitable fabricators and entrepreneurs.

Activity 2.4.2: Investigation and formulation of appropriate procurement procedures, cost sharing schemes, incentives and market delivery mechanisms

After the value chain actors are mapped out and their potential roles, responsibilities and rights ascertained, the joint project and Social Business team will formulate a framework for partnership among FD, ICRAF and the entrepreneurs that is workable, effective and provides benefits and incentives to all parties concerned. This will entail detailed discussions with all parties concerned and the use of the startup grant and loan guarantee models. Support mechanisms in the form of capacity development (technical, business and accounting training) and/or financing incentives to micro-entrepreneurs will be agreed as part of the public-private partnerships that has been proposed under Appendix C. Such mechanisms will be made in synergy with other activities in this Project.

Support from GEF is not necessary to conduct this activity.

Activity 2.4.3: Implementation of public-private partnerships for the installation of efficient kilns

The implementation of the public-private partnerships formulated in Activity 2.3.2 will be the bases for the implementation and dissemination of efficient charcoal kilns targeted in this Project. The aim is for private enterprises to take up roles in the project cycle that are best done by the private sector and eventually doing it through normal market mechanisms without any government intervention or support.

GEF support is needed for local transportation, accommodation and per diem costs of partners personnel to meet with the private sector and establish public-private partnerships.

Activity 2.4.4: Conduct of training and awareness campaign on the use, maintenance and benefits of energy-efficient kilns

Selected members of Charcoal Producers Association will be trained in best practices in the charcoal production process and in the assembly and management of retort kilns based on the Charcoal Production Manual to be developed under Output 3.1. The Charcoal Producers Association and CBOs will conduct awareness campaign to make the members and producers aware of the benefits of energy-efficient kilns and create a demand for aspirational kilns. They will also organize training among potential kiln end-users on the use and maintenance of the promoted kilns. These activities will be conducted at the village level and will target producers using traditional kilns. Sub-county and district leaders, and communities will be sensitized on the dangers of unsustainable charcoal production. The training will cover the following topics:

- i. Introduction to carbonization technologies (Kilns and Retorts),
- ii. The concept of efficiency in charcoal production and implications of yields, profits and resource management.
- iii. Introducing the concept of Green House Gas Emissions and the impact on agriculture production.
- iv. Wood preparation; why wood should be split to size, the benefits of drying billets and proper stacking of billets.
- v. Retort/Kiln operation; process control and harvesting charcoal, how to test for good quality charcoal.

GEF support is needed to conduct the training.

Activity 2.4.5: Regular monitoring and evaluation of installed kilns

The Project team working with CPA and CBOs, will ensure that the pilots are monitored and evaluate, and that the results and lessons learned are disseminated through their agencies and organizations. This will be an ongoing process, with benchmarks for evaluation twice during Year 1, then every year, with particular attention paid to Year 4. Monitoring will be on the use of the kilns by the producers and get feedback on the benefits they get, their difficulties and problems in using them and their suggestions for improvement. Their feedback will be compiled and analyzed by the Team and used as part of the Monitoring, Verification and Enforcement (MVE) programmes under Output 2.6 and considered in the future improvement of the design of the kilns and their dissemination mechanisms.

Cost to CPA and CBOs in the conduct of this activity is budgeted in Activity 2.4.3.

Activity 2.4.6: Improvement in the design based on results of the monitoring and evaluation activities

It is likely that the feedback from the kiln end-users through regular monitoring and evaluation activities will yield suggestions for CCDC and MOE that will improve the function or feature of the kilns. These feedback and suggestions will be considered and improvements in the design will be incorporated into future design of the kilns to be manufactured and disseminated.

GEF support for financing laboratory, instrumentation and measuring devices and providing materials for improvement of kilns design at CCDC and MOE is budgeted under Output 1.4.

Activity 2.4.7: Promotion and replication of re-designed kilns to remaining producers

Once an improved design is complete, a new wave of promotion and replication will be conducted in the remaining producers that have not yet availed of the promoted kilns. The dissemination of the re-designed kilns will be conducted in accordance with the prioritization plan that will be implemented in phases as described in Appendix C of the Prodoc. This activity will contribute to the MVE activities under the phasing out plan to be developed under Output 2.6.

GEF support is needed to co-share in financing the CPA and CBOs for the promotion and replication of re-designed kilns.

Output 2.5: Locally produced 14,000 energy-efficient stoves in rural households for cooking needs implemented and promoted for replication

This output will build upon the progress made by existing actors in the country to develop a viable market system for the production and distribution of energy efficient cookstoves, and will scale this up nationally reaching households in all 13 districts of the country. Given the different types of consumers in Sierra Leone, there will be more than one type of cookstove design and business model promoted through this output.

The primary focus will be up-scaling of stoves that have been tested and certified under Output 1.3 (e.g. the Kenyan Jiko Stove promoted by WestWind Energy in Sierra Leone and Toyola Energy in Ghana). The cookstove uses key components but is assembled and finished locally, and is 40% - 50% efficient in terms of firewood consumption, and reduces emissions by 60-70%. This will be confirmed in the new testing labs to be set up under Output 1.3. The production and distribution model consists of selected enterprises that is producing different components and producing stoves. These businesses will retail the stoves from their premises in Freetown and also sells the stoves wholesale to small shops and kiosks in Freetown and to a network of businesses it has established in rural areas of the country.

In addition, these businesses act as a lead firm in supporting other micro-enterprise producers in Freetown, providing training and selling production inputs and manufacturing equipment. To-date, informal trainings are taking place but these will be formalized and upgraded with certificates.

Under this output, it is anticipated that more than 30 microenterprises stove producers will be trained, certified and established in Freetown and in district towns around the country. Training where participants will be at least 50% youth or women will be provided by the lead firms in Freetown, and the small cost of initial tools and parts for production will be subsidized (Startup Programme), will be provided on credit by the lead firms, or will be enabled by access to a microfinance loan (e.g. BRAC) to be developed under Output 2.2. The Loan guarantee scheme developed under Output 2.2 will also be tested, monitored and evaluated and upgraded during project implementation.

Activity 2.5.1: Preparation of design drawings, construction procedures and manuals for the construction and operation of energy-efficient stoves

Private sector partners with international expert will assist in completing a cookstove technology landscape survey and a menu of alternative designs will be prepared and will be provided to potential end-users. For the three basic designs and selected alternatives, documentation will be prepared to facilitate construction and operation. Community and household consultations will be a continuous feature of this activity to ensure the stoves meet consumer needs and expectations. This documentation includes design drawings, construction handbooks and operation manuals. Technology fact sheets will also include enough graphics so as to be used as guidelines by illiterate men and women.

GEF fund is necessary for TA on preparation of design drawings, construction procedures and manuals for the construction and operation of stoves. The TA will be combined with Activities 2.3.1 and 2.3.2.

Activity 2.5.2: Agreement with local fabricators on the production of the furnaces/stoves and training on their design and operation features

The domestic cookstoves and institutional stoves will use mainly local materials such as mud and clay with metal reinforcements. The production and installation of these stoves will be done by a locally trained technician at the town and village level. Thus, the production procedures and details of engagements with both the fabricators and local technicians would be customized to the type of stove they will produce.

In both cases, training of fabricators and technicians will be arranged and conducted by the lead company in partnership with UNDP Social Business programme and service provider using trainers from experts (e.g. WestWind Energy, Toyola Energy, Bokarie) and Cookstove and Charcoal Development Centre (CCDC). The EEPUC project will work closely with DOE, REC and CCDC to ensure its capacity is built to sustain the training and expansion of local fabricators and technicians after the project ends. As part of the work of the EEPUC to assist the Government in establishing incentives for cookstove and kiln applications (Activity 2.1.2), the local entrepreneurs would be provided access to financing their initiatives or ventures (e.g. startup grant and voucher scheme) related to the fabrication or production of stoves.

GEF will partially fund the TA on the training of fabricators and technicians on design, construction and operation of furnaces/stoves and provide materials for fabrication and construction training and local transportation, accommodation and per diem costs of trainers.

Activity 2.5.3: Production, installation and dissemination of furnaces/stoves to end-users

The indicative mechanisms for delivery and roll-out of these stoves is essential. The main entities whose role will be crucial in the widespread dissemination of the stoves are the community-based organizations (CBOs) and development partners such as WFP, Oxfam, Concerns International that have local presence in the districts and villages. CBOs such as EFO, Women Union, Oxfam, World Vision, etc., have experience in successfully mobilizing communities to build facilities such as agroforestry, toilets, community halls and even houses. Women's and youth groups will also be engaged.

GEF support is necessary in providing incentives for stoves and co-share cost to CBOs.

Activity 2.5.4: Conduct of training and awareness campaign on the use, maintenance and benefits of energy-efficient furnaces/stoves

The CBOs will conduct awareness campaign to make the individuals and community institutions aware of the benefits of energy-efficient furnaces/stoves and create a demand for aspirational stoves. They will also organize training among potential end-users on the use and maintenance of the promoted stoves. These activities will be conducted at the village level and will target both institutional and household users as well as men and women members of the households.

GEF support is needed to produce training materials.

Activity 2.5.5: Regular monitoring and evaluation of installed furnaces/stoves

Part of the responsibilities of the CBOs will be to regularly monitor the use of the stoves by the end-users and get feedback on the benefits they get, their difficulties and problems in using them and their suggestions for improvement. Their feedback will be compiled and analyzed by the Team and used as part of the Monitoring, Verification and Enforcement (MVE) programmes under Output 2.6 and considered in the future improvement of the design of the stoves and their dissemination mechanisms.

Cost to CBOs in the conduct of this activity is budgeted in Activity 2.4.3.

Activity 2.5.6: Improvement in the design based on results of the monitoring and evaluation activities

It is likely that the feedback from the end-users through regular monitoring and evaluation activities will yield suggestions for CCDC and DOE that will improve the function or feature of the stoves. These feedback and suggestions will be considered and improvements in the design will be incorporated into future batches of stoves to be manufactured and disseminated.

GEF support for financing laboratory, instrumentation and measuring devices and providing materials for improvement of stoves design at CCDC and DOE is budgeted under Output 1.4.

Activity 2.5.7: Promotion and replication of re-designed furnaces/stoves to remaining households and community-based institutions

Once an improved design is complete, a new wave of promotion and replication will be conducted in the remaining households and community institutions that have not yet availed of the promoted stoves. The dissemination of the re-designed stoves will be conducted in accordance with the prioritization plan that will be implemented in phases as described in Appendix C. This activity will contribute to the MVE activities under the phasing out plan to be developed under Output 2.6.

GEF support is needed to co-share in financing the CBOs for the promotion and replication of re-designed furnaces/ stoves.

2.6 Established and operational framework for the phase-out of traditional charcoal kilns and cook stoves

National policies and programmes that support the phase-out of inefficient cookstoves and charcoal kilns significantly improve energy efficiency, reduce fuel wood demand and reduce greenhouse gas (GHG) emissions and deforestation. Monitoring, Verification and Enforcement (MVE) schemes can increase compliance and are an essential part of a national efficient cooking energy strategy. MVE activities directly support the Standard, Certification and Labeling program that will provide the baseline data on the efficiency of the stove and charcoal kilns and assess the impact of the intervention over times. This component will also collaborate with GERES and GACC in a study to collect baseline data on the volume and market share of different stoves.

Without continuous compliance procedures, non-compliant products compromise the effectiveness of efficient cooking programmes and policies. Beyond Standard, labeling efficient cookstove and certification of charcoal kilns, rigorous MVE can encourage the entry of more energy efficient cooking products and kiln technology into their marketplace and help to phase out obsolete technology.

Activity 2.6.1: Develop a strong Monitoring, Verification and Enforcement (MVE) programmes

This activity will seek to establish the rationale for and value of MVE and its related objectives for the bioenergy sector. The programmes will determine the essential elements of an MVE implementation such as programme entry conditions and various options for handling non-compliant products in the market. Policy recommendations, policy options and priorities for policymakers and programme managers will be developed for implementing and integrating MVE with standards and labelling programmes. The laboratory testing capacity and regional cooperation and potential for harmonization within ECOWAS will be strengthened to increase the effectiveness while reducing costs.

Activity 2.6.2: Support Designated National Authority (DNA) to develop and leverage carbon finance

To ensure that the pilots are financially sustainable beyond the GEF project and based on the finding from Output 2.2 (incentives), this activity will support the DNA and SLEPA in collaboration with UNDP's MDG Carbon Programme and Toyola Energy to explore the feasibility to develop a pipeline of carbon finance project for improved cookstoves and efficient charcoal production as Program of Activities (PoA) under an appropriate Voluntary Carbon Standard authority or as Nationally Appropriate Mitigation Actions (NAMA) project. The steps to develop carbon project and means to

reduce upfront transaction cost as Standardized baselines are detailed in Appendix C of the Prodoc – Carbon Project and Standardized Baselines.

Component 3. Improved, more efficient production and efficient utilization of certified charcoal and cookstove

Outcome 3: The production and utilization of certified charcoal and certified improved cook stoves are common practices in Sierra Leone.

In order to ensure the sustainability of the bioenergy solutions and business beyond the pilot and demonstration phase and to avoid the reliance on rebate in the country, the capacity of the public, private and CSO and end users stakeholders must be strengthened, supported and continually improved. This will ensure that the local social entrepreneurs, CSO community and bioenergy champions as value chain actors and technical and business services providers are fully supported to leverage public and private sector resources. This outcome seeks to build strong social capital along with technical, environmental and financial capitals. This outcome will generate strong buy in from the public and private stakeholders so that appropriate resources (budget, efforts, passion) are mobilized to ensure continual sustain bioenergy growth for market transformation. This will ensure that public goods and services are delivered cost effectively and efficiently so that the poor, marginalized and disadvantaged are empowered to access to opportunity and narrow the income gaps between rural and urban population. To ensure that trainings are cost effective and result-based, the training will not be limited to academic presentations and documentations but will include a dominant share of pragmatic hands-on, 'learning by doing' and peer to peer training.

Educating the end users to make informed decision will rely on awareness raising as a public good through billboards, radio etc, to understand the current behavior and habits and how improved cooking devices could improve their lives, health and household economies; and telling the end users how to differentiate a good "real" improved cookstove from those that claim to be, via the Standard, Certification and Labelling system. This type of consumer education will be carried in collaboration with DOE and Center of Excellence like the Renewable Energy Center and CCDC.

Output 3.1: Developed gender sensitive capacity development and modules for the production and utilization of certified charcoal and ICS

Activity 3.1.1: Organize workshop for communication and capacity building strategy and action planning and development of training modules

To mark the start of the activities in Component 3, which deals with capacity development, a participatory workshop will be organized and conducted with all relevant stakeholders to brainstorm and establish a communications and capacity development strategy for the Project. This will result in a roadmap for the preparation of a coherent and well-targeted communications and capacity development action plan to inculcate project ownership and development of local bioenergy champions. The lessons learned and gained in the production, marketing and dissemination of stoves and charcoal kilns and the aspects showing best practices will be produced and documented as knowledge products (e.g. Charcoal and Improved Cookstove Production and Marketing Manual) to be used for training under Output 2.3; 2.4; 2.5 and 3.3.

GEF funding is needed to pay for the workshop organizational costs and production of training manuals and handouts.

Activity 3.1.2: Preparation of an integrated capacity development plan to include policy, institutions, BET technologies and applications, sustainable fuel wood agroforestry and utilization, and market provisions of energy services

Taking guidance from the result of the workshop in Activity 3.1.1, the Team will prepare a detailed integrated capacity development plan covering different aspects of policy and institutional framework, cookstove and kiln technologies and applications, sustainable fuel wood agroforestry and utilization, and market provisions of energy services. The plan will consider the target groups,

needs of both men and women involved in the different biomass energy technology applications and types of capacity development activities, among others.

Output 3.2 Developed and implemented promotional schemes on the social, economic and environmental co-benefits of improved charcoal and improved cook stoves to create demand, generate good buy-in and willingness to pay

Activity 3.2.1: Documentation, regular production and dissemination of information related to biomass energy resources and successful efficient charcoal and improved cookstove business

Using the set up and communications strategy of the Research, Knowledge, Learning and Coordination Center, the EEPUC Project will regularly produce information and knowledge products related to biomass energy resources as well as project lessons and best practices and disseminate these to target audience (e.g. Women Group, schools) through newsletters, radio (jingles, drama) and other appropriate mass media. The aim is to develop and operationalize a market information system to stimulate the market through public awareness and advertising campaigns to promote the use of clean/cleaner technologies.

GEF funding is needed for the production of publications.

Output 3.3 Sensitized key value chain actors through public awareness campaign and capacity development

Activity 3.3.1: Preparation work and organization of training on the installation, operation and maintenance of energy-efficient furnaces/stoves/kilns

Other than the training that will be conducted by the technology suppliers for the operators of the plants, training on the different aspects of installation, operation and maintenance of energy-efficient furnaces/stoves/kilns will be organized for selected representatives of communities and institutions. The preparation work will include the selection and invitation of participants, selection of the date of the training, selection and booking of the venue, invitation of resource persons, preparation of handouts and other preparatory activities.

GEF support is not required to implement this activity.

Activity 3.3.2: Conduct of training on the installation, operation and maintenance of energy-efficient furnaces/stoves/kilns

This training is aimed to develop technical skills and capabilities of members of communities, government agencies and institutions so that there will be a pool of individuals who could be tapped for the construction, operation or maintenance of new projects, in order to enable the growth of cookstove and kiln service market. Such training, which will be conducted by the same resource person (or from the same firm) selected to conduct the TA for Activity 3.3.2, will incorporate hands-on exposure in the kiln systems implemented by EEPUC.

GEF support is required to partially fund the skill-based training on renewable energy and environmentally friendly construction and the associated costs such as local transportation, accommodation and per diem costs, production and translation of handouts/materials and costs of organizing the training.

1.2 Key indicators, risks and assumptions

The most direct global benefit of this project as it relates to GEF objectives is the reduction in GHGs emission chiefly CO₂. Other associated benefits to Sierra Leone include more access to clean bioenergy solutions for the Sierra Leonean people; development of appliances standards and guidelines; more stable renewable biomass supply and less dependency on non-renewable

biomass; greening up of the value chain in the cottage industry. All these will contribute to the overall sustainability of the project and thus are critical to the continued reduction in CO₂ emissions.

The following indicators could be used to measure the impact of the proposed initiatives. The detailed indicators of the EEPUC Project according to outputs are provided in the Project Results Framework (Section 3).

Table 10: Indicators to measure the impact of proposed initiatives

Measurable Indicators	Source of Verification
Quantity of GHG emissions mitigated	<ul style="list-style-type: none"> GHG emission mitigation calculations; Surveys, Statistics reports from SSE; EEPUC project activity and M&E reports
<ul style="list-style-type: none"> Reduction of non-sustainable fuel wood consumption for energy use in households and industries. Enterprises supplying clean and efficient biomass energy systems and services. Households and industries that adopted, and are benefiting from the use energy-efficient furnaces/stoves/kilns. 	<ul style="list-style-type: none"> Household and industry surveys; EEPUC project M&E Reports Household and industry surveys; EEPUC project M&E Reports Household and industry surveys; EEPUC project M&E Reports
<ul style="list-style-type: none"> No. of sustainable biomass energy production businesses that were proposed and developed as influenced by the strengthened policy and institutional frameworks for the deployment of EE and biomass energy businesses Policies and legal frameworks (S and L) that are supportive of EE applications and biomass energy business development Funding made available for EE application projects 	<ul style="list-style-type: none"> Business plans of companies interested in biomass energy production; Industry surveys; EEPUC project activity and M&E reports Documentation of new and approved policies and legislations (S and L) for supporting EE applications Documentation of financial agreements for EE projects Surveys; EEPUC project activity and M&E Report
<ul style="list-style-type: none"> Production of improved cook stoves (ICS) and efficient charcoal kilns Increased ICS and kilns utilisation by consumers Energy efficient furnaces/stoves/kilns and industrial stoves installed & used Investments on EE technology applications 	<ul style="list-style-type: none"> Surveys; EEPUC project activity and M&E reports Surveys; EEPUC project activity and M&E reports Surveys; EEPUC project activity and M&E reports Surveys; EEPUC project activity and M&E reports Survey of MFIs; EEPUC project activity and M&E reports
<ul style="list-style-type: none"> Fuel wood savings from the cost-effective and efficient use of biomass energy in rural communities 	<ul style="list-style-type: none"> EEPUC project activity and M&E reports
<ul style="list-style-type: none"> New EE replication projects 	<ul style="list-style-type: none"> Reports on the performance of replication projects; EEPUC project activity and M&E reports

<ul style="list-style-type: none"> • Financial support schemes (e.g., start up grant, end user rebate, loan products) developed for scaling up and replicating successful EE projects • Local financial institutions that provide financial schemes to support EE projects • Funds earmarked by participating MFIs for financing BET projects 	<ul style="list-style-type: none"> • Documentation of formulated financial support schemes; EEPUC project activity and M&E reports • Documentation of agreements with MFIs in the implementation of financial support schemes; EEPUC project activity and M&E reports • MFI reports on its EE loan portfolio; EEPUC project activity and M&E reports
<ul style="list-style-type: none"> • Local manufacturing enterprises that can fabricate and install equipment/components used in EE systems • Trained and qualified men and women technicians working on EE application projects • Trained men and women technicians who are qualified to repair and maintain EE equipment and installations • Trained and qualified men and women in rural communities gainfully engaged in community forestry and woodlot operations operated by partners • Local development plans integrate biomass energy use, EE applications, and biomass industry development • Local men and women financial officers that are capable of evaluating biomass energy and other EE and RE project proposals • Local entrepreneurs and SMEs that are gainfully involved in businesses that make up the value chain of the EE application industry 	<ul style="list-style-type: none"> • Company profile of qualified local manufacturing firms fabricating and installing EE system equipment and components • Company profile of qualified local engineering firms working on EE application projects; job certifications of technical staff • Company profile of qualified local technical services firms doing R&M work on EE system facilities; job certifications of technical staff • Company profile of local firms working on sustainable forestry projects; job certifications of technical staff • Documentation on local development plans in selected towns • Profile of banks/FIs with EE and RE project loan portfolios; job certifications of technical staff • Survey of companies involved in the upstream and downstream activities in the EE application industry

Based on discussions with stakeholders, it is expected that the overall project risk will be moderate. The potential risks, which could hinder the successful project implementation and/or reduce project effectiveness, are itemized in Table 10. To address these anticipated risks, the project will be designed to include an effective means to monitor, and to the extent possible, mitigate these risks. A project monitoring & evaluation plan has been prepared to track not only the project milestones, but also the indicators that will show that the identified risks are, if not eliminated – at least mitigated. Stakeholders were engaged during the project design stage. The measures that have been taken during the preparation and design of the Project and/or will be taken during the implementation phase so that these potential risks will be mitigated are outlined in Table 11.

Table 11: Mitigating Risks			
Type	Level	Risk	Mitigation
Policy and Legislative Risk	Moderate	<p>In Sierra Leone, legislative processes are usually very cumbersome and it may take several months or years to complete one circle of legislation. The proposed project may likely experience the following risks:</p> <ul style="list-style-type: none"> • Legislative delay that may go beyond the project life span. • Inability of members and low buy in of the Sierra Leonean Parliament to fully understand the entire concept of energy efficiency and the importance thus may not show much interest in the issues. • Slow/delayed adoption of the new law and policy by the Sierra Leonean. • The mandates of SSE and other relevant agencies to the project are not revised timely. This may pose a threat to the project. 	<p>The current project will put in place activities to adequately enlighten policy makers and legislators at the outset of the project to enable them understand the urgency and importance of the project.</p> <p>Bioenergy Steering Committee will be formed to provide an active platform for dialogue and to enlighten the lawmakers, industry and consumers on the cost-benefit of the project and opportunity cost of inaction.</p>
Technical Risk	Low	<p>The success of this project will largely depend on adequately increasing the technical capacity of the relevant institutions, such as the SSE, R and D, Forestry Division etc. The following are therefore potential risks:</p> <ul style="list-style-type: none"> • lack of project ownership • the willingness of the staff of these institutions to adopt new knowledge and practice • insufficient training of laboratories staff, manufacturers, importers and retailers in the implementation of the labeling program • lack of adequate training of key stakeholders to the project • inadequate training on procedures for energy consumption measuring, calculation of energy efficiency index and enforcement procedures. 	<p>Bottom-up, participatory training approach will be used to generate greater ownership. To mitigate this risk, adequate provision will be made to train staff of these institutions to imbibe the new technology.</p> <p>Training and enhancement of the capacity of relevant agencies and stakeholders is a key component of the current project.</p>
Economic and political Risk	Medium	<ul style="list-style-type: none"> • The Sierra Leonean economy is highly dependent on oil import. Any increase in the price of oil in the international market may have significant impacts on the volume of economic activities in Sierra Leone. The current and future price of fossil fuel could influence the uptake and buy in of bioenergy options. A drop in international and regional oil prices would diminish the attractiveness of bioenergy measures and therefore could likely threaten the willingness of the stakeholders to engage in the proposed bioenergy reform & strategy. • Political upheaval and instability could affect economic development and the uptake of bioenergy technology 	<p>The current international forecast indicates that the price of oil is likely to remain high over the short term. Political reforms are constantly being introduced to provide stability for economic growth that would incorporate bioenergy strategy.</p> <p>This is not considered a significant risk. The 2010 Presidential and Parliamentary elections in Sierra Leone were remarkably peaceful, and further significant outbreaks of violence are considered unlikely.</p>

Financial Risk	High	<p>To promote bioenergy in Sierra Leone will require a significant investment on the part of the Government and other development partners. Therefore the likely risks to be associated with this project are:</p> <ul style="list-style-type: none"> • The Government and many of these development partners may be unwilling to put in this quantum of investment. • The unstable nature of the exchange rates of both local and foreign currencies and high interest rates. • The higher upfront cost of bioenergy appliances (improved cookstove, kiln) may be a deterrent to consumers. 	<p>The project will put in place a strategic public-private partnership, complementing adequate structures, mechanisms, policy and legislation that will encourage investment in the sector.</p>
Marketing/Distribution Risk	Low	<p>Insufficient numbers of households purchase alternative energy technologies to conduct useful analysis</p> <p>The anomalies in the Sierra Leone marketing/distribution system such as the proliferation of traditional and substandard products, monopoly of distribution etc., may pose a potential danger to the success of the project. This makes the current business environment not conducive to the development of bioenergy.</p>	<p>This is considered extremely unlikely. Prior to implementing the program, conducted an extensive viability study, and in the course of the program all indications show that very large numbers of households will choose to purchase energy technologies.</p> <p>This will be addressed by the current project by putting in place the right policy and legislation and setting up a stringent mechanism for enforcement.</p>
Information Risk	Low	<p>Though may be considered as low risks but they may impact on the project:</p> <ul style="list-style-type: none"> • There is low level of awareness on the potentials of bioenergy solutions to bring about economic development and environmental sustainability. • There is also lack of thorough communication with key policy makers. • More also, there is lack of an accurate reporting of existing legal and regulatory framework. • Not many Sierra Leonean have information on the existence and availability of bioenergy appliances. • Illiteracy and general low capacity among households in target areas poses challenges in terms of data collection and impact measurement 	<p>This will be addressed by creating knowledge products and awareness using all type of media (TV, radio, newspaper) and using NGOs already working on bioenergy projects.</p> <p>The implementation of a bioenergy policy will be included as a component of procurement policy to help the country adapt to the adoption of bioenergy.</p> <p>Using local CBO who has extensive experience of working with these types of households in Sierra Leone and in many other countries around the world. CBO will design the research tools to take into account respondent capacities, and minimize the risk of respondent incomprehension and bias.</p>

1.3 Financial modality

The EEPUC Project seeks to develop and promote market transformation policy (S and L) and financial de-risking (Start-up grant, end user rebate, incentives to create demand) instruments for the efficient scaling up of improved cookstoves and efficient charcoal kilns businesses. Without GEF intervention some baseline activities will be performed and funded by the GoSL through agencies such as the DOE, FD, EPA-SL. Funding from other donor organizations, including parallel activities, are also expected. These include funding from the UNDP's Business Development Services, the GEF Small Grant Programme, charcoal producers and the private cottage industries that will be hosting the scaling up projects. Development partners like EU, Toyola Energy, WonderStove will fund parallel activities on implementation of domestic and institutional cookstove for cooking and efficient retort kilns for charcoal production. The individual households, whenever they need new stoves or replace their old ones, will continue to make their own or purchase the traditional stoves using their own funds.

1.4 Cost Effectiveness

The proposed project targets the realization of a substantial increase in the sustainable and efficient use of biomass energy resources for the provision of energy services in Sierra Leone's urban and rural sector (i.e., for household, community and rural industry uses and charcoal uses) facilitated through the barrier removal activities focusing on institutional strengthening, regulatory framework, capacity building, market development and other technical assistance activities that will be implemented. During the project inception phase, targeted consultations will be held with local entrepreneurs to participate in the demonstrations projects, through investments in land, premises and hardware of the projects. Also, Component 1 of the proposed project focuses strongly on specific development and implementation of a roadmap for sustainable bioenergy promotion, to be complemented with recommendations for fiscal incentives from the Ministry of Finance, as well as earmarked areas for sustainable bioenergy production.

At the end of the Project, approximately 433,568 tCO₂e emissions will be avoided directly, through the scaling up of 15,000 improved stoves and 1,000 charcoal kilns. Throughout the life of the same stoves and the implemented charcoal kilns, and without the benefit of additional installations, the cumulative GHG mitigation is expected to be at least 1,617,253 tCO₂e, giving a cost of less than USD 1.09 of GEF resources/tonne of CO₂ emissions avoided. This clearly shows that the approach of barrier removal for this project is more cost-effective than the Clean Development Mechanism and other carbon financing schemes.

The project's cost effectiveness will be tracked using the Tracking Tool for Climate Change Mitigation Projects developed by GEF.

1.5 Sustainability

Sustainability of the proposed project will depend upon various factors including the quality of the bioenergy appliances available on the market through S and L program, and the technical assistance and capacity building program to ensure that all sectors involved gain full ownership of the tools and methods to be used. One of the purposes of this project is to stimulate sufficient demand for EE and bioenergy solutions and measures so that: (i) the use of bioenergy efficient appliances in the residential, institutional and industrial sector will become an accepted practice; and (ii) local industry will continue to invest in time, material and people to build a strong, local knowledge base.

By the end of this GEF technical assistance and investment project, sustainability of project results will be ensured by:

Scaling up of improved cook stove and efficient kilns as market based and inclusive value chain business model where the poor, women and youth could be empowered to participate as value chain actors;

- Establishing a Centre of Excellence within the MOE that will be responsible for conducting technical feasibility studies to evaluate new bioenergy solutions, techniques and appliances, as well as developing and updating the bioenergy policy and legislation (major revisions to the bioenergy policy, regulation and strategy can be expected every five years on average);
- Establishing an internationally accredited testing and certification center at Renewable Energy Center, CCDC for the development of new bioenergy solutions;
- Development of local social entrepreneurs, champions and service providers along the value chain using market based approach with access to affordable loans;
- Updating the regulatory and institutional framework governing bioenergy up-scaling and deployment;
- Providing training to manufacturers, importers, distributors, retailers, consumers, engineers, enforcement agencies;
- Creating a National Bioenergy Steering Committee with members from DOE, Forestry Division, CBOs (ICRAF, EFO, EFA, WHL, Concern) etc that will ensure harmonization of bioenergy policies and activities among key stakeholders and will promote an ongoing policy and investment dialog between public and private stakeholders.
- Enhancing the capacity of the DNA to develop high quality carbon project for leverage carbon and green climate finance.

Regarding the project's financial sustainability, it is important to note that there will not be a need for a similar project in the future in the country once the identified barriers are removed. A change in regulation and adoption of a new set of rules for the bioenergy policy and legislation of Sierra Leone – if done right – should be an irreversible process unless there is a major policy reversal that could not have been anticipated. The issue of marketing imported or locally made inferior sub-standard cook stove and kilns will be the object of attention throughout the project.

The programme has been designed to optimize the chances of the DOE, REC and CCDC being sustainable by the end of the programme. This includes:

- Locating the DOE and CCDC in an existing learning institution, so DOE and CCDC staff are integrated into a broader institutional structure;
- Ensuring host institution commitment to the DOE and CCDC and a sustainability plan is part of the selection process for the DOE and CCDC location;
- Developing an operating and business model that takes account of the need for financial sustainability in the long-term
- Adopting a facilitation role rather than a direct management role, so that DOE and CCDC staff take responsibility for the activities and outreach
- Engaging a broad spectrum of stakeholders (the Government, civil society and the private sector) to maximize interest in clean bioenergy and therefore demand for DOE and CCDC services
- Integrating clean bioenergy training into the curriculum of the learning institution, so that the DOE and CCDC has a permanent role beyond research and external training
- Linking the DOE and CCDC to a network of bioenergy centers connected to ARC and the GACC, and working to build partnerships between the DOE and CCDC and other regional institutions or organizations.

1.6 Replicability

As the biomass, bioenergy and forestry sector are being developed to better align productive capacity with demand for sustainable feedstock, demand side management (DSM) initiatives will remain a key component of the Sierra Leone's strategy to rationalize the bioenergy and biomass market. By bringing together manufacturers/importers and buyers in an effort to improve the efficiency of appliances, demonstrates the relevance of the project that seeks to reduce the impact of high energy costs on household budgets. This is especially true where rising standards of living are encouraging the acquisition of low-cost aspirational bioenergy products and services of questionable quality.

The project intends to work closely with relevant trade and professional associations (such as Charcoal Producers Association, UN Women) national and local government agencies (DOE, Forestry Division), consumer associations and other CBOs to remove technical, regulatory and informational barriers. Training workshops will be provided to private sector operators under the auspices of the MFI and manufacturer/fabricators/masons.

The project has a component to promote improved cookstove and efficient kiln system through regular distribution channels and trade association to educate and influence buyers and producers at the retail locations and association functions. The project has a second component to provide a public education campaign through consumer organizations and selected media to change consumer mindsets by explaining the importance of looking at the total life cycle cost of ownership. Given the size of Sierra Leone's domestic market, the project will collaborate with consumer organizations in the three largest urban markets in Sierra Leone for appliance sales to ensure a broad diffusion of bioenergy awareness among consumers and retailers. The establishment of these enabling conditions will facilitate the replacement of traditional cook stoves at country level.

The goal will be to develop transparent certification and labeling standards for the industry, publicize the labeling regulatory requirements, and sensitize consumers to the need to consider the total life cycle cost in making purchase decisions. If the demonstration effect for the appliances considered in this project can be successful, then a replicable model can be applied to other appliances on a consensus basis between manufacturers/importers, regulatory agencies and consumer protection groups.

1.7 Global Environmental Benefits

The activities of the Project consisting of the dissemination of 15,000 efficient cook stoves, as well as the implementation for the scaling up of 1,000 kilns through methane avoidance and firewood savings, will result in the reduction of GHG emissions amounting to approximately 433,568 tCO₂e at the end of the Project.

1.7.1 GHG Emission Mitigation from the Use of Improved Cook Stoves

As explained earlier, the Project will introduce efficient stoves in three categories, namely: cook stoves, institutional stoves and industrial stoves. These stoves will replace traditional less efficient stoves currently being used by many households in Sierra Leone. Due to the much higher efficiency of the new stoves, less fuel wood will be used up for the same cooking and thermal needs derived by the end-users of the stoves. As the sources of the wood fuel are currently not coming from managed community forest plantation, the quantity of fuel wood saved and that will not be burned will therefore cause avoidance of carbon dioxide emissions that would otherwise have been generated by the uncontrolled combustion of fuel wood in the traditional stoves. The cutting of trees from forests will also be reduced.

The GHG annual emission mitigation from stoves can be calculated as follows:

GHG emission mitigation = amount of fuel wood saved annually by the efficient stove x the emission factor of fuel wood x the number of stoves introduced

In order to provide a conservative estimate on the different parameters and assumptions leading to the calculation of the GHG emission, the UNFCCC approved methodology (AMS-II.G/Ver.02) was used. The details of the calculations for each type of stove are given in Annex F. The main parameters used in the calculations and the sources of information are shown in Table 12 below.

Table 12: Assumptions used in GHG emission mitigation calculation			
Parameters	Value	Source of Information	Remarks
Efficiency of old stoves			
Cook stoves	10%	EFO/GERES	All these estimated parameters will be verified during project implementation
Institutional stoves	8%	WFP	
Industrial stoves	10%	ECREEE	
Efficiency of new stoves			
Cook stoves	40%	GERES	
Institutional stoves	45%	ECREEE	
Industrial stoves	50%	ECREEE	
Quantity of fuel wood consumed per stove per day	Cookstove = 11 (8-15) kg Institutional = 50 (60-80) kg Industrial = 180 (150-250) kg	EFO/EU	
Emission factors			
Fuel wood	122 tCO ₂ /TJ	IPCC default value	
Kerosene	71.5 tCO ₂ /TJ	IPCC default value	Use kerosene for conservatism
Net calorific value of biomass	0.015 TJ/tonne	IPCC default value	

a. Life-time Direct GHG Emissions Avoided

The 15,000 stoves will be disseminated in different phases and at different years. Lifetime direct emissions avoided attributable to the investments made during the projects supervised implementation period, totaled over the respective lifetime of the investments is presented in Table 14, 15 and 16. The summary of the expected annual and cumulative fuel wood savings and GHG mitigation as a result of using the efficient stoves is shown in Table 13. Table 14 shows the fuel wood savings and GHG mitigation according to the different types of stoves. The life of the stoves supported in this Project is expected to be about five years, with the industrial stoves, which is made of metal and cement, lasting slightly more than that. Thus, giving an average of five years from the end of Year 2, the stoves that are supported by the Project by utilizing the institutional and financing scheme set up within the Project, and disseminated through its roll-out mechanism, are expected to mitigate GHG emissions until the end of Year 8. Table 14 presents details of the summary in Table 13 - total lifetime direct GHG emissions avoided.

Table 13: SUMMARY: Lifetime Direct GHG Emissions Avoided	
Description	Indicator Performance
	Total @ End of Project
Fuel wood saved (tonnes)	485,468
GHG emissions mitigated (tCO ₂ e)	520,665

Table 14: First 4 year direct GHG emission mitigation of stoves				
Year	1	2	3	4
Cook stoves				
No. of installed stoves	400	3,100	8,100	14,000
Fuel wood saved annually (tonnes)	1,205	9,335	24,391	42,158
GHG emissions mitigated annually (tCO ₂ e)	1,292	10,012	26,159	45,214
Institutional stoves				
No. of installed stoves	8	50	294	700
Fuel wood saved annually (tonnes)	110	684	4,024	9,581
GHG emissions mitigated annually (tCO ₂ e)	117	734	4,316	10,276
Industrial stoves				
No. of installed stoves	8	50	150	300
Fuel wood saved annually (tonnes)	876	5,475	16,425	32,850
GHG emissions mitigated annually (tCO ₂ e)	940	5,872	17,616	35,232
Total				
No. of installed stoves	416	3,200	8,544	15,000
Fuel wood saved annually (tonnes)	2,190	15,494	44,840	84,589
Cumulative fuel wood saved (tonnes)	2,190	17,684	62,525	147,113
GHG emissions mitigated annually (tCO₂e)	2,349	16,618	48,091	90,721
Cumulative tCO₂e mitigated	2,349	18,966	67,058	157,779

b. Total lifetime direct GHG emission mitigation

The life of the stoves supported in this Project is expected to be about five years, with the industrial stoves, which is made of metal and cement, lasting more than that. Thus, giving an average of five years from the end of Year 2, the stoves that are supported by the Project by utilizing the institutional and financing scheme set up within the Project, and disseminated through its roll-out mechanism, are expected to mitigate GHG emissions until the end of Year 8. Hence, the total lifetime direct GHG emission mitigation has been calculated and the results are shown in Table 15 hereunder.

Table 15: Total lifetime direct GHG emission mitigation of stoves								
Year	1	2	3	4	5	6	7	8
Cook stoves								
No. of installed stoves	400	3,100	8,100	14,000	14,000	14,000	14,000	14,000
Fuel wood saved annually (tonnes)	1,205	9,335	24,391	42,158	42,158	42,158	42,158	42,158
GHG emissions mitigated annually (tCO ₂ e)	1,292	10,012	26,159	45,214	45,214	45,214	45,214	45,214
Institutional stoves								
No. of installed stoves	8	50	294	700	700	700	700	700
Fuel wood saved annually (tonnes)	110	684	4,024	9,581	9,581	9,581	9,581	9,581
GHG emissions mitigated annually (tCO ₂ e)	117	734	4,316	10,276	10,276	10,276	10,276	10,276
Industrial stoves								
No. of installed stoves	8	50	150	300	300	300	300	300
Fuel wood saved annually (tonnes)	876	5,475	16,425	32,850	32,850	32,850	32,850	32,850
GHG emissions mitigated annually (tCO ₂ e)	940	5,872	17,616	35,232	35,232	35,232	35,232	35,232
Total								
<i>No. of installed stoves</i>	<i>416</i>	<i>3,200</i>	<i>8,544</i>	<i>15,000</i>	<i>15,000</i>	<i>15,000</i>	<i>15,000</i>	<i>15,000</i>
<i>Fuel wood saved annually (tonnes)</i>	<i>2,190</i>	<i>15,494</i>	<i>44,840</i>	<i>84,589</i>	<i>84,589</i>	<i>84,589</i>	<i>84,589</i>	<i>84,589</i>
<i>Cumulative fuel wood saved (tonnes)</i>	<i>2,190</i>	<i>17,684</i>	<i>62,525</i>	<i>147,113</i>	<i>231,702</i>	<i>316,291</i>	<i>400,880</i>	<i>485,468</i>
<i>GHG emissions mitigated annually (tCO₂e)</i>	<i>2,349</i>	<i>16,618</i>	<i>48,091</i>	<i>90,721</i>	<i>90,721</i>	<i>90,721</i>	<i>90,721</i>	<i>90,721</i>
<i>Cumulative tCO₂e mitigated</i>	<i>2,349</i>	<i>18,966</i>	<i>67,058</i>	<i>157,779</i>	<i>248,500</i>	<i>339,222</i>	<i>429,943</i>	<i>520,665</i>

c. Post-project indirect (Project replication) GHG emission mitigation

The design of the Project emphasizes on sustainability of its activities, including the dissemination of more stoves through market mechanisms and where, in special circumstances, continuation of rebate from the GoSL. It is targeted that, due to activities and support attributable to the Project, ten years after the end of the Project (i.e., influence period), the penetration of the stoves nationwide will be about 6% (60,683 units) of the total households of the current 1,006,475. This means an increase of about 15% annually in the number of operating stoves. The GHG emission mitigation given this situation up to Year 14 (ten years after the end of the Project), referred to as the post-project indirect GHG emission mitigation, is given in Table 16. Years 9-13 are not shown in the table for layout considerations.

Table 16: Post-Project direct GHG emission mitigation of stoves									
Year	1	2	3	4	5	6	7	8	14
Cook stoves									
No. of installed stoves	400	3,100	8,100	14,000	16,100	18,515	21,292	24,486	56,638
Fuel wood saved annually (tonnes)	1,205	9,335	24,391	42,158	48,481	55,753	64,116	73,734	170,551

1.7.2 GHG Emission Mitigation from Charcoal kilns System

The production and consumption of charcoal lead to high associated GHG emissions. These GHG emissions are the result of three factors:

- An unsustainable supply of biomass in which forests are being depleted for the production of this fuel
- The use of inefficient technologies to convert wood into charcoal with yields as low as 15-20% observed in Sierra Leone
- The use of specific technologies/processes in which the conversion of wood into charcoal leads to a high level of methane emissions

GHG emissions mitigated annually (tCO ₂ e)	1,292	10,012	26,159	45,214	51,996	59,795	68,765	79,079	182,916
Institutional stoves									
No. of installed stoves	8	50	294	700	805	926	1,065	1,224	2,832
Fuel wood saved annually (tonnes)	110	684	4,024	9,581	11,018	12,671	14,572	16,758	38,762
GHG emissions mitigated annually (tCO ₂ e)	117	734	4,316	10,276	11,817	13,590	15,628	17,973	41,572
Industrial stoves									
No. of installed stoves	8	50	150	300	345	397	456	525	1,214
Fuel wood saved annually (tonnes)	876	5,475	16,425	32,850	37,778	43,444	49,961	57,455	132,891
GHG emissions mitigated annually (tCO ₂ e)	940	5,872	17,616	35,232	40,516	46,594	53,583	61,620	142,532
Total									
No. of installed stoves	416	3,200	8,544	15,000	15,000	15,000	15,000	15,000	60,686
Fuel wood saved annually (tonnes)	2,190	15,494	44,840	84,589	97,277	111,869	128,649	147,946	342,205
Cumulative fuel wood saved (tonnes)	2,190	17,684	62,525	147,113	244,390	356,259	484,908	632,854	2,122,059
GHG emissions mitigated annually (tCO₂e)	2,349	16,618	48,091	90,721	104,330	119,979	137,976	158,672	367,012
Cumulative tCO₂e mitigated	2,349	18,966	67,058	157,779	262,109	382,088	520,064	678,736	2,276,051

The calculation of GHG emissions from the methane avoidance and fuel substitution due to the installation of efficient kiln is made using the UNFCCC-approved consolidated methodology ACM0021 as detailed in Annex G.

a. Life-time Direct GHG Emissions Avoided

The 1,000 charcoal kilns will be disseminated in different phases and at different years. Lifetime direct emissions avoided attributable to the investments made during the projects supervised implementation period, totaled over the respective lifetime of the investments is presented in Table 17 and 18. The summary of the expected annual and cumulative fuel wood savings and GHG mitigation as a result of using the efficient stoves is shown in Table 17. Table 18 shows the fuel wood savings and GHG mitigation according to the different types of stoves. The life of the stoves supported in this Project is expected to be about five years, with the industrial stoves, which is made of metal and cement, lasting slightly more than that. Thus, giving an average of five years from the end of Year 2, the stoves that are supported by the Project by utilizing the institutional and financing scheme set up within the Project, and disseminated through its roll-out mechanism, are expected to mitigate GHG emissions until the end of Year 8. Table 17 presents details of the summary in Table 19 - total lifetime direct GHG emissions avoided.

Table 17: SUMMARY: Lifetime Direct GHG Emissions Avoided		
Description	Indicator Performance	
	Annual/unit	Total @ End of Project
Quantity of methane avoided (tonnes)	510	2,040
Quantity of non-renewable fuel wood substituted (tonnes)	6,763	27,054
GHG emissions mitigated (tCO ₂ e)	68,947	275,789

b. Total lifetime direct GHG emission mitigation

Considering a lifetime of 10 years for the kiln, the yearly and accumulated lifetime CO₂ emission savings from the avoidance of methane and fuel wood substitution are given in Table 18. As equipment are assumed to be installed towards the end of Year 1 of the project implementation, it is assumed that the equipment will continue operating for another nine years after the end of the Project.

Table 18: Total lifetime direct GHG emission mitigation of charcoal kilns		
Description	Indicator Performance	
	Annual average	Total (9 years)
Quantity of methane avoided (tonnes)	510	3,285
Quantity of non-renewable fuel wood substituted (tonnes)	6,763	208,738
GHG emissions mitigated (tCO ₂ e)	68,947	1,096,589

c. Post-Project indirect GHG emission mitigation

Based on interviews with members of the Charcoal Producers Association and demand projection from population growth, it is estimated conservatively that the technical potential kilns that could be developed in Sierra Leone is about 1,500. Assuming that, due to activities and support attributable to the Project, the kiln technologies up-scaling are replicated so that the number of kilns is increased at a modest rate of 5% per year, in 15 years after the end of the Project the number of kiln would have reached around 1,710, which represent more than country's potential. The amount of fuel wood substituted would be 430,621 tonnes through the introduction of the clean retort kiln system. The GHG emission reduced through this replication process (Post-Project indirect GHG emission mitigation) is presented in Table 19.

Table 19: Post-Project indirect GHG emission mitigation of charcoal kilns		
Description	Indicator Performance	
	Annual average	Total (15 years)
Quantity of	510	6,812

methane avoided (tonnes)		
Quantity of non-renewable fuel wood substituted (tonnes)	6,763	430,621
GHG emissions mitigated (tCO ₂ e)	68,947	4,389,765

1.7.3 GHG Emission Mitigation from Other Sources

The use of energy efficient stoves to replace the traditional ones is expected to reduce the consumption of wood fuel. This would therefore reduce the cutting of trees for fuel use, which would increase carbon capture from the seedlings and trees and improved land management. During the Project implementation, the parameters needed to calculate the GHG emission mitigation from carbon capture of seedlings and trees will be monitored with the aim of establishing the mitigation from this source.

1.8 Cross Cutting Issues

1.8.1 Gender Equity Issues

Women's participation, representation and access to resources and benefits will be a key focus of this project that aims to provide access to improved household energy needs through clean cooking stoves, advanced biomass cook stoves and bio-digesters. The project will contribute towards social, economic governance transformations to empower women through specific activities that: promote participatory and consultative planning for decision-making; improve women's capabilities through their involvement, as consumers and producers in pilots and as role models; and, advance their influence in decision-making as well as control over natural resources. The project will have specific gender goal indicators, which will include the collection of gender-disaggregated data and a strong monitoring and evaluation mechanism to operate and advance gender mainstreaming and social equity.

Fuel wood use for domestic purposes is synonymous with women in Sierra Leone. Although women may share the task of collecting fuel wood with men, they are entirely responsible for cooking in the households. Therefore, this Project, which is addressing wood use in stoves, will directly impact women. The Project will work closely with partners such as FD, ICRAF and EU-REDD+ who are establishing wood plantations and wood energy enterprises that will also directly enhance access of women to fuel wood in community forests and therefore reduce the time that women spend collecting fuel wood from forests that are far from villages. The EEPUC Project will therefore affect the time of women in wood collection, ease of operation of stoves and will contribute to improving the health of women who spend significant time in the kitchen. Women also regularly maintain the stoves to keep them in a condition that will ease their operation. It is therefore imperative that the EEPUC include women as an important target group in its activities conducted at the community level.

In addition, women entrepreneurs are constrained by family and traditional obligations and have usually lack of access to credit, technology and low business skills. Development efforts do not sufficiently address the multi-dimensional constraints to women's active participation in the economy in the country. There is no cohesive approach to gender mainstreaming in the economy within the government, NGO, or donor sectors and the business developing and training of the Project will have specific focus on developing businesses run by women.

1.8.2 Poverty and MDG

Market segmentation study shows that about 43% of the respondents live below the poverty line. The Project is expected to contribute to poverty reduction through savings on women's time and better health of people by reducing indoor pollution. Consequently, villagers will have less days of sickness thereby enhancing their productivity. The delivery of stoves will also create employment at the village level. Villagers like skilled masons, including women, will be targeted as trainees for constructing the improved stoves.

The Project will introduce improved stoves at a cost. The stoves will be delivered at a rebate but villagers will have to mobilize the remaining cost of the stoves. The rural poor with no or few means of earning cash would find it difficult to mobilize money to pay for the cost of the stoves. Although provision of credit through the MFI has been considered under the project, the poor would still not be able to access credit because of the need for collateral as a pre-requisite for taking loans. The poor would therefore risk to be excluded from the Project benefits. A means of managing this risk is by linking poor villagers in the first stage of the roll-out of stoves (when rebate rates are higher) with micro-finance institutions that are currently being initiated through the GoSL's support.

1.8.3 Socio-Economic Benefits

The EEPUC Project is expected to provide socio-economic benefits to communities using improved stoves. The improved stoves are more efficient and will use less fuel wood so households will not have to collect as much fuel wood as used now. There would be cash savings as villagers' costs for royalty paid for fuel wood and money spent for transportation would be reduced. People's time mainly that of women and children spent on collecting fuel wood would be saved. Women could potentially use that time for other productive activities.

Under the project, improved stoves will be constructed out of locally available materials but the design would require certain level of skills. The project will train village women and local masons in constructing stoves so these people could then disseminate the stoves in the villages. There is therefore potential for employment of these trained stove technicians supplementing their income through payment for stove building activities. Within EEPUC, communities with registered community forests could earn additional revenues by producing fuel wood for sale to communities that are facing fuel wood shortages, while at the same time providing a more sustainable alternative of fuel supply for these communities.

1.8.4 Sustainable Forest and Land Management

The EEPUC Project is expected to provide alternative local employment and sustainable livelihood that will avoid encroachment into protected forest. The promotion of micro-nurseries and tree management and business skills being promoted by ICRAF will allow the farmers to practice sustainable forest and land management vital for providing environmental services. The improved stoves and kilns are more efficient and will use less fuel wood so that the pressure on the fragile forest will be less severe.

1. SL EEPUC PROJECT RESULTS FRAMEWORK

This project will contribute to achieving the following Country Programme Outcome as defined in CPAP or CPD: By 2018, targeted Government institutions, the private sector, and local communities manage natural resources in a more equitable and sustainable way.
Country Programme Outcome Indicators: Detailed regulatory bioenergy framework supporting dissemination of bioenergy technologies Number of households in remote Chiefdom using renewable energy with increased income generation opportunities
Primary applicable Key Environment and Sustainable Development Key Result Area (same as that on the cover page, circle one): 1. Mainstreaming environment and energy OR 2. Catalysing environmental finance OR 3. Promote climate change adaptation OR 4. Expanding access to environmental and energy services for the poor.
Applicable GEF CC-M Focal Area Objective: Objective 2: Promote market transformation for energy efficiency in industry and the building sector
Applicable GEF Expected Outcomes: Outcome 2.2: Sustainable financing and delivery mechanisms established and operational
Applicable GEF Outcome Indicators: tonnes CO ₂ e avoided

1.9 Project Planning Matrix

Strategy	Objectively Verifiable Indicators			Source of Verification	Critical Assumptions
	Indicators	Baseline	Targets		
Project Goal: Reduction of GHG emissions in the rural household and industrial sectors of Sierra Leone through integrated and sustainable biomass resource production and utilization, and promotion of sustainable biomass energy technologies in Sierra Leone using market based approaches.	<input type="checkbox"/> Quantity of GHG emissions mitigated annually by End of Project (EOP), tCO ₂ e.	<input type="checkbox"/> 0	<input type="checkbox"/> Up to 159,668 (68,947+90,721)	<input type="checkbox"/> GHG emission mitigation calculations; Statistics reports from DoE; EEPUC project activity and M&E reports <input type="checkbox"/> Surveys; Statistics reports from DoE; EEPUC project activity and M&E reports	<input type="checkbox"/> Recognition of the government on importance of reducing GHG emissions and continuing commitment towards it.
	<input type="checkbox"/> Total cumulative quantity of GHG emissions mitigated by EOP, tCO ₂ e.	<input type="checkbox"/> 0	<input type="checkbox"/> Up to 433,568 (275,789 + 157,779)		
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

<p>Project Objective: Removal of barriers to sustainable production and utilization of biomass resources in Sierra Leone and application of biomass energy technologies to support local economic, environmental and social development that leads to GHG mitigation.</p>	<p><input type="checkbox"/> Reduction of fuel wood consumption for energy use in households and industries by EOP, tonnes.</p>	<p><input type="checkbox"/> 0</p>	<p><input type="checkbox"/> Up to 174,167</p>	<p><input type="checkbox"/> Household and industry surveys; EEPUC project M&E Reports</p>	<p>Assumptions:</p>
	<p><input type="checkbox"/> No. of enterprises supplying clean and efficient charcoal by EOP.</p>	<p><input type="checkbox"/> 0</p>	<p><input type="checkbox"/> At least 1,000 efficient kilns</p>	<p><input type="checkbox"/> Industry surveys; EEPUC project activity and M&E Reports</p>	<p><input type="checkbox"/> Government continues to have the political will to support policies and actions that would promote clean and efficient stoves and kilns applications</p>
	<p><input type="checkbox"/> No. of households and industries that adopted, and are benefiting from, the energy-efficient furnaces/stoves by EOP.</p>	<p><input type="checkbox"/> 0</p>	<p><input type="checkbox"/> Up to 15,000</p>	<p><input type="checkbox"/> Household surveys; EEPUC project activity and M&E Reports</p>	
<p>Component 1: Policy/regulatory frameworks on the use of more efficiently produced charcoal and improved cook stoves</p>					
<p>Outcome 1: <i>Strengthened institutional capacity on biomass resource utilization at the national, regional and community level. Operational effective policy, legal, and regulatory frameworks and review mechanisms on biomass energy technology applications</i></p>	<p><input type="checkbox"/> No. of sustainable charcoal and improved cookstoves production businesses that were proposed and developed as influenced by the strengthened policy and institutional frameworks for the deployment of stoves and kilns and biomass energy businesses by Year 2</p>	<p><input type="checkbox"/> 0</p>	<p><input type="checkbox"/> 46 improved cookstove and 100 charcoal producers</p>	<p><input type="checkbox"/> Business plans of companies interested in biomass energy production; Industry surveys; EEPUC project activity and M&E reports</p>	<p><input type="checkbox"/> Government continues to see biomass as a priority energy resource to support the country's sustainable economic development</p>
	<p><input type="checkbox"/> No. of biomass energy utilization projects that are planned and developed for PURE/SURE purposes by EOP</p>	<p><input type="checkbox"/> 0</p>	<p><input type="checkbox"/> 15,000 improved cookstoves and 1,000 end users</p>	<p><input type="checkbox"/> Documentation of proposed and planned biomass energy supported PURE/SURE projects by the GOT and private sector</p>	

	<input type="checkbox"/> No. of policies and legal frameworks that are supportive of BET applications and biomass energy business development approved and enforced by Year 3	<input type="checkbox"/> 0	<input type="checkbox"/> 1	<input type="checkbox"/> Documentation of new and approved policies and legislations for supporting bioenergy applications	
	<input type="checkbox"/> Volume of funding made available for BET application projects by EOP, US\$ <input type="checkbox"/> No. of relevant government agencies and institutions involved in biomass energy production and are linked with each other via a working mechanism for coordination by EOP.	<input type="checkbox"/> 0 <input type="checkbox"/> 0	<input type="checkbox"/> USD 200,000 (at least) <input type="checkbox"/> 5	<input type="checkbox"/> Documentation of new and approved policies and legislations for supporting bioenergy applications <input type="checkbox"/> Documentation of financial agreements for bioenergy projects - Surveys; EEPUC project activity and M&E Report <input type="checkbox"/> Documentation of Government memos and MOU on the collaborative work on BET promotion activities	
Component 2: Development of public-private initiatives for the improved and more efficient production of charcoal and the scaling up of improved cookstove production					
Outcome 2: Increased number of investments on improved, more efficient charcoal and ICS production in Sierra Leone	<input type="checkbox"/> No. of improved cook stoves produced (ICS) by Year 4	<input type="checkbox"/> 0	<input type="checkbox"/> 15,000	<input type="checkbox"/> Surveys; EEPUC project activity and M&E reports	
	<input type="checkbox"/> No. of ICS bought and utilized by consumers annually starting Year 4	<input type="checkbox"/> 0	<input type="checkbox"/> 15,000	<input type="checkbox"/> Surveys; EEPUC project activity and M&E reports	
	<input type="checkbox"/> No. of installed efficient charcoal kilns that are operational by EOP.	<input type="checkbox"/> 0	<input type="checkbox"/> 1,000	<input type="checkbox"/> Surveys; EEPUC project activity and M&E reports	

	<input type="checkbox"/> No. of institutional furnaces/stoves installed & being used on a daily basis by households in targeted areas by EOP	<input type="checkbox"/> 0	<input type="checkbox"/> 700	<input type="checkbox"/> Surveys; EEPUC project activity and M&E reports	
	<input type="checkbox"/> No. of industrial stoves installed and are operational by EOP.	<input type="checkbox"/> 0	<input type="checkbox"/> 300	<input type="checkbox"/> Surveys; EEPUC project activity and M&E reports	
	<input type="checkbox"/> Total volume of investments on biomass energy technology applications by EOP, US\$ million	<input type="checkbox"/> 0	<input type="checkbox"/> USD 500,000	<input type="checkbox"/> Survey of FIs; EEPUC project activity and M&E reports	
Component 3: Improved, more efficient production and efficient utilization of certified charcoal and cookstove					
Outcome 3.1: The production and utilization of certified charcoal and certified improved cook stoves are common practices in Sierra Leone	<input type="checkbox"/> No. of new proposed and planned project developments that replicates successfully operating stoves and kilns application projects by Year 4	<input type="checkbox"/> 0	<input type="checkbox"/> 3	<input type="checkbox"/> Documentation of project plans; EEPUC project activity and M&E reports	
	<input type="checkbox"/> No. of stoves and kilns replication projects that are approved and for implementation by Year 4	<input type="checkbox"/> 0	<input type="checkbox"/> 3	<input type="checkbox"/> Documentation of approved project plans; EEPUC project activity and M&E reports	
	<input type="checkbox"/> No. of completed stoves and kilns replication projects by EOP	<input type="checkbox"/> 0	<input type="checkbox"/> 3	<input type="checkbox"/> Reports on the performance of replication projects; EEPUC project activity and M&E reports	
Outcome 3.2 Enhanced capacity of stakeholder in the value chain (producers, farmers, villagers, women, consumers, collectors)	<input type="checkbox"/> No. of local manufacturing firms that can fabricate and install equipment/components used in stoves and kilns systems by Year 4	<input type="checkbox"/> 1	<input type="checkbox"/> 146	<input type="checkbox"/> Company profile of qualified local manufacturing firms fabricating and installing bioenergy system equipment and components	

	<input type="checkbox"/> No. of trained and qualified men and women technicians working on stoves and kilns application projects by EOP	<input type="checkbox"/> 0	<input type="checkbox"/> 3,000 champions	<input type="checkbox"/> Company profile of qualified local engineering firms working on bioenergy application projects; job certifications of technical staff
				<input type="checkbox"/> Company profile of qualified local technical services firms doing R&M work on bioenergy system facilities; job certifications of technical staff
	<input type="checkbox"/> No. of local development plans that integrate biomass energy use, stoves and kiln applications, and biomass industry development prepared by local government men and women planners by EOP	<input type="checkbox"/> 0	<input type="checkbox"/> 5	<input type="checkbox"/> Company profile of local firms working on sustainable forestry projects; job certifications of technical staff
	<input type="checkbox"/> No. of local men and women financial officers that are capable of evaluating biomass energy and other RE project proposals by EOP	<input type="checkbox"/> 0	<input type="checkbox"/> 15	<input type="checkbox"/> Documentation on local development plans in selected towns
	<input type="checkbox"/> No. of local entrepreneurs and SMEs that are gainfully involved in businesses that make up the value chain of the bioenergy application industry by EOP	<input type="checkbox"/> 0	<input type="checkbox"/> 25	<input type="checkbox"/> Profile of banks/FIs with RE project loan portfolios; job certifications of technical staff <input type="checkbox"/> Survey of companies involved in the upstream and downstream activities in the bioenergy application industry

1.10 Total Budget and Financial Planning

Award ID:	00081156	Project ID: 00090575
Award Title:	Energy Efficient Charcoal (EEPUC)	
Business Unit	SLE10	
Project Title	Energy Efficient Production and Utilization of Charcoal through Innovative Technologies and Private Sector Involvement in Sierra Leone (EEPUC)	
PIMS No.	4904	
Implementing Partner (Executing Agency)	UNDP (DIM Project)	

GEF Outcome/Atlas Activity	Responsible Party/Implementing Agent	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Total (USD)	See Budget Note:
1. Policy and regulatory frameworks on the use of more efficiently produced charcoal and improved cook stoves	UNDP	62000	GEF	71200	International Consultants	50,000			-	50,000	1
				71200	International Consultants	55,000		-	-	55,000	2
				75700	Training, Workshops and Conference	2,000	1,000	1,000	2,000	6,000	3
				71600	Travel	5,000	5,000	2,000	2,000	14,000	4
					Sub-total GEF	112,000	6,000	3,000	4,000	125,000	
					Total Outcome 1	112,000	6,000	3,000	4,000	125,000	
2. Development of public-private initiatives for the improved and more efficient production of charcoal and the scaling up of improved cookstove production				72100	Contract services-Companies	30,000	30,000	30,000	19,320	109,320	5
				72100	Contract services-Companies	30,000	36,000	-	-	66,000	6
				71300	Local Consultants	8,000	8,000	8,000	8,000	32,000	7
				71600	Travel	4,000	4,000	4,000	3,000	15,000	8
				71600	Travel	2,000	1,000	1,000	2,000	6,000	9
				72600	Grants	15,120	64,080	99,200	125,280	303,680	10
				72600	Grants	150,000	130,000	140,000	98,000	518,000	11
72600	Grants	50,000	70,000	60,000	70,000	250,000	12				

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					Sub-total GEF	289,120	343,080	342,200	325,600	1,300,000	
					Total Outcome 2	289,120	343,080	342,200	325,600	1,300,000	
3. Improved, more efficient production and efficient utilization of certified charcoal and cookstove	UNDP	62000	GEF	71200	International Consultants	50,000	45,000	45,000	45,000	185,000	13
				71300	Local Consultants	6,000	6,000	6,000	6,000	24,000	14
				75700	Training, Workshops and Conference	1,000	1,000	1,000	1,000	4,000	15
				71600	Travel	1,000	1,000	1,000	1,000	4,000	16
				72500	Supplies	-	1,000	1,000	1,000	3,000	17
				72400	Communications & Audio Visual Equipment	1,500	1,000	1,000	1,500	5,000	18
					Sub-total GEF	59,500	55,000	55,000	55,500	225,000	
	Total Outcome 4	59,500	55,000	55,000	55,500	225,000					
Project Management	UNDP	62000	GEF	71300	Local Consultants	10,000	10,000	8,000	8,000	36,000	19
				71600	Travel	1,800	1,200	1,200	1,200	5,400	20
				71600	Travel	4,000	4,000	4,000	4,000	16,000	21
				72200	Equipment and Furniture	3,000	1,340	500	942	5,782	22
				75700	Training, Workshops and Conference	5,000	-	-	-	5,000	23
				71200	International Consultants	-	20,000	-	-	20,000	24
				71200	International Consultants	-	-	-	30,000	30,000	25
					Sub-total GEF	23,800	36,540	13,700	44,142	118,182	
	Total Project Management	23,800	36,540	13,700	44,142	118,182					
				PROJECT TOTAL	484,420	440,620	413,900	429,242	1,768,182		

Summary of Funds¹⁴

Funding Sources	Amount	Amount	Amount	Amount	Total (USD)
	Year 1 (USD)	Year 2 (USD)	Year 3 (USD)	Year 4 (USD)	
GEF	484,420	440,620	413,900	429,242	1,768,182
UNDP (In kind)	53,000	53,000	48,000	46,000	200,000
SLEPA-EU (in kind)	1,300,000	1,300,000	1,300,000	1,116,000	5,016,000
ICRAF BioDev	190,000	214,000	202,000	217,314	823,314
Bockarie Kargo	40,000	35,000	45,000	30,000	150,000
Toyola Energy	25,000	25,000	25,000	25,000	100,000
WestWind Enegy	50,000	50,000	50,000	50,000	200,000
Samu	25,000	25,000	25,000	25,000	100,000
GERES	15,000	15,000	10,000	10,000	50,000
GoSL (In kind)	137,000	137,000	119,000	107,000	500,000
BRAC	460,916	460,916	400,357	359,985	1,682,174
TOTAL	2,780,336	2,755,536	2,638,257	2,415,541	10,589,670

¹⁴Summary table should include all financing of all kinds: GEF financing, cofinancing, cash, in-kind, etc...

Budget Note:

1	International Biomass Technology expert will, with assistance of local consultants, design the bioenergy roadmap
2	International RE policy expert will assist FD, with the assistance of local consultants, design the bioenergy policy
3	Training Workshop
4	Hiring of vehicles for local use
5	Local firms will provide technical services to develop the cookstoves programme
6	Local firms will provide technical services to develop the stove programme
7	National Energy and Biomass Technology Expert to assist International experts to project implementation
8	Hiring of local transport
9	Per diem to cover for local travel
10	Subsidy for stoves programme
11	Start-up grant and loan guarantee fund for efficient charcoal kilns
12	Loan guarantee fund for the scaling up of efficient charcoal kilns
13	International Energy and Biomass Technology Expert to develop training materials and conduct training
14	National Capacity Development Expert to assist International experts to develop training materials and conduct training
15	Organise workshops for public, private and CSO stakeholders
16	DSA for local travels
17	Publication of training materials
18	Development of knowledge products
19	Local professional will be hired as Project Coordinator to co-ordinate and manage the project, with assistance from an Administrative and Finance Assistant
20	Cost to cover for regional travel for study tours
21	Vehicle rental to local travels
22	Purchase of office furniture and equipment
23	Inception workshop to introduce the project
24	International consultant to conduct mid term review of project
25	International consultant to conduct final review of project

2.1.3. Project Implementation Schedule

Activities	Responsibility	Schedule																Partners involved
		Year 1				Year 2				Year 3				Year 4				
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Output 1.1 Adequately trained and capable decision-makers and relevant stakeholders (from EPA-SL, ministries, private sector, rural communities, etc.) leading efforts, communicating and managing more efficiently produced charcoal and improved cookstove utilization in an integrated manner																		
Activity 1.1.1: Creation, establishment and operation of Research, Knowledge, Learning and Coordination Center (RKLCC) at DOE	UNDP-CO	X	X															PT, DOE, FD, CESG
Activity 1.1.2 Preparation work and organization of training on efficient charcoal production and utilization	UNDP-CO	X					X					X				X		PMU, DOE, UNDP CO, CESG
Activity 1.1.3 Conduct of training on efficient charcoal production and utilization	UNDP-CO	X	X				X				X				X			DOE, FD, CESG
Activity 1.1.4 Generating public sector buy in through advocacy on co-benefits analysis and project impact	UNDP-CO	X	X				X				X				X			DOE, FD, CESG
Output 1.2: Formulated, approved and enforced policies, laws and regulations on more efficient charcoal and improved cookstoves production																		
Activity 1.2.1: Stakeholder consultations to define and formulate the Cooking Energy Action Plan	UNDP-CO	X	X															PMU, DOE, FD, CESG
Activity 1.2.2: Support the Government approval process of Cooking Energy Action Plan for sustainable charcoal production and utilization and improved cookstoves	UNDP-CO		X															PMU, DOE, FD, CESG

Activity 1.2.3: Roll-out of the Cooking Energy Action Plan for implementation and promotion of sustainable charcoal and improved cookstoves businesses	UNDP-CO		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	PT, PMU, DOE, FD, CESG
Activity 1.2.4: Preparation of detailed regulatory frameworks, containing regulations, procedures, standards and incentives for the smooth and effective implementation of biomass energy applications	UNDP-CO	X	X															PT, PMU, DOE, FD, CESG
Output 1.3 Developed standards and certification for more efficiently produced charcoal and improved cookstove																		
Activity 1.3.1 Select institution in which the CCDC will be located	UNDP-CO	X	X	X	X													PT, PMU, DOE, FD, REC, GERES, ECREE, CESG
Activity 1.3.2 Organise 4 weeks training for staff from the CCDC (and other supporting institutions) at Aprovecho Research Centre (ARC)-accredited labs in Nigeria or Senegal	UNDP-CO		X	X	X													PT, PMU, DOE, FD, REC, GERES, ECREE, CESG
Activity 1.3.3 Set-up cookstove and charcoal testing laboratory in CCDC	UNDP-CO		X	X	X													PT, PMU, DOE, FD, REC, GERES, ECREE, CESG
Activity 1.3.4 Develop standard from fuel-efficiency and emissions testing of all existing cookstoves in Sierra Leone	UNDP-CO		X	X	X													PT, PMU, DOE, FD, REC, GERES, ECREE, CESG
Activity 1.3.5 Facilitate iterative design improvements and strategic new stove designs by the CCDC	UNDP-CO		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	PT, PMU, DOE, FD, REC, GERES, ECREE, CESG
Output 2.1 Established partnerships between the public and private stakeholders involved in the value chain of charcoal production and utilization and improved cookstove																		
Activity 2.1.1: Inventory and assessment of relevant community-based organizations	UNDP-CO	X	X															PT, PMU, DOE, FD, CBO, ICRAF
Activity 2.1.2: Identification of roles of community-based organizations and agreement on modalities and incentives for their participation	UNDP-CO	X	X															PT, PMU, DOE, FD, CBO, ICRAF
Output 2.2. Developed incentives through carbon finance, microfinance, start up grant, rebate and loan guarantee schemes to scale up sustainable charcoal and improved cookstove businesses																		
Activity 2.2.1: Reviewed lessons learnt in the financing and scaling up of sustainable charcoal and improved cookstoves business	UNDP-CO		X	X														PT, PMU, DOE, TA

Activity 2.2.2: Establishment of procedures, implementing arrangement, oversight and modalities for the implementation of start up grant and end user rebate scheme	UNDP-CO		X	X	X															PT, PMU, DOE, BRAC, UNDP Social business
Activity 2.2.3 Design and implementation of the loan risk guarantee funding scheme for entrepreneurs in the stoves/furnaces supply chain business	UNDP-CO		X	X	X															PT, PMU, DOE, BRAC, UNDP Social business
Activity 2.2.4: Implementation of financing schemes and incentives for demonstrated kilns and cookstoves applications & services	UNDP-CO				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	PT, PMU, DOE, CBO, UNDP-SB, BRAC
Output 2.3: Implemented and operational i) 300 locally produced industrial stoves for income generating local enterprises such as fish smoking, bakery, palm oil processing and tobacco curing and ii) 700 institutional stoves for school, prisons and hospitals.																				
Activity 2.3.1 Identification of local fabricators, raw material suppliers and micro-entrepreneurs and their specific areas of involvement	UNDP-CO		X	X																PT, DOE, BRAC, PMU, UNDP-SB, Host agency
Activity 2.3.2 Investigation and formulation of appropriate procurement procedures, cost sharing schemes and market delivery mechanisms	UNDP-CO		X	X	X															PT, DOE, BRAC, PMU, UNDP-SB, Host agency
Activity 2.3.3 Implementation of public-private partnerships for the production & delivery of energy efficient stove/furnace	UNDP-CO		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	PT, DOE, BRAC, PMU, UNDP-SB, Host agency, BRAC

Output 2.4: Implemented and operational 1,000 locally produced efficient kilns for the sustainable production of certified charcoal.																				
Activity 2.4.1: Identification of local producers/masons, raw material suppliers and micro-entrepreneurs and their specific areas of involvement	UNDP-CO	X	X	X	X															DOE, REI, ICRAF, CCDC
Activity 2.4.2: Investigation and formulation of appropriate procurement procedures, cost sharing schemes, incentives and market delivery mechanisms	UNDP-CO			X	X	X														PT, DOE, CRAF, Private sector
Activity 2.4.3: Implementation of public-private partnerships for the installation of efficient kilns	UNDP-CO				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	PT, DOE, CBOs, Private sector, ICRAF,
Activity 2.4.4: Conduct of training and awareness campaign on the use, maintenance and benefits of energy-efficient kilns	UNDP-CO				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	PT, DOE, CRAFT, CBOs, Private sector, Community
Activity 2.4.5: Regular monitoring and evaluation of installed kilns	UNDP-CO					X	X	X	X	X	X	X	X	X	X	X	X	X	X	PT, DOE, ICRAF, CBOs, Private sector, Community

Activity 2.4.6: Improvement in the design based on results of the monitoring and evaluation activities	UNDP-CO										X	X	X						DOE, CBOs, CCDC, Private sector, Community
Activity 2.4.7 Promotion and replication of re-designed kilns to remaining producers	UNDP-CO										X	X	X	X	X	X	X	X	PT, DOE, ICRAF, CBOs, Private sector, Community
Activities for output 2.5: Implemented and operational locally produced 14,000 energy efficient cook stoves for households																			
Activity 2.5.1 Preparation of design drawings, construction procedures and manuals for the construction and operation of energy-efficient stoves	UNDP-CO	X	X	X	X														DOE, REI
Activity 2.5.2 Agreement with local fabricators on the production of the furnaces/ stoves and training on their design and operation features	UNDP-CO			X	X	X													PT, DOE, ICRAF Private sector
Activity 2.5.3 Production, installation and dissemination of furnaces/stoves to end-users	UNDP-CO				X	X	X	X	X	X	X	X	X	X	X	X	X	X	PT, DOE, ICRAF, CBOs, Private sector
Activity 2.5.4 Conduct of training and awareness campaign on the use, maintenance and benefits of energy-efficient furnaces/stoves	UNDP-CO				X	X	X	X	X	X	X	X	X	X	X	X	X	X	PT, DOE, ICRAF, CBOs, Private sector, Community
Activity 2.5.5 Regular monitoring and evaluation of installed furnaces/ stoves	UNDP-CO					X	X	X	X	X	X	X	X	X	X	X	X	X	PT, DOE, ICRAF CBOs,

																			Private sector, Community
Activity 2.5.6 Improvement in the design based on results of the monitoring and evaluation activities	UNDP-CO										X	X	X						DOE, CBOs, CCDC, Private sector, Community
Activity 2.5.7 Promotion and replication of re-designed furnaces/stoves to remaining households and community-based institutions	UNDP-CO										X	X	X	X	X	X	X	X	PT, DOE, ICRAF, CBOs, Private sector, Community
2.6 Established and operational framework for the phase-out of traditional charcoal kilns and cook stoves																			
Activity 2.6.1: Develop a strong Monitoring, Verification and Enforcement (MVE) programmes	UNDP-CO		X	X	X														PT, PMU, DOE
Activity 2.6.2: Support Designated National Authority (DNA) to develop and leverage carbon finance	UNDP-CO			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	PT, PMU, DOE, UNDP MDG, Toyola Energy
Output 3.1: Developed gender sensitive capacity development and training modules for the production and utilization of certified charcoal and ICS																			
Activity 3.1.1 Workshop for communication and capacity building strategy and action planning	UNDP-CO		X																PMU, DOE, CESG, CCDC, REC PT, FD, Media, Trainers
Activity 3.1.2 Preparation of an integrated capacity building plan to include policy, institutions, kiln and cookstove technologies and applications, sustainable fuel wood plantation and utilization, and market provisions of energy services	UNDP-CO		X	X															PMU, PMU, DOE, CCDC, CESG, REC PT, FD, Media, Trainers
Output 3.2 Developed and implemented promotional schemes on the social, economic and environmental co-benefits of improved charcoal and improved cook stoves to create demand, generate good buy-in and willingness to pay																			
Activity 3.2.1 Documentation, regular production and dissemination of information related to biomass energy resources and kiln and cookstove	UNDP-CO				X	X	X	X	X	X	X	X	X	X	X	X	X	X	PMU, DOE, PT, CESG, CCDC,

application and utilization																			FD
Output 3.3 Sensitized key value chain actors through public awareness campaign and capacity development																			
Activity 3.3.1: Preparation work and organization of training on the installation, operation and maintenance of energy-efficient furnaces/stoves/kilns	UNDP-CO				X				X				X					X	PMU, DOE, PT CCDC,
Activity 3.3.2: Conduct of training on the installation, operation and maintenance of energy-efficient furnaces/stoves/kilns	UNDP-CO DOE, Stakeholders, Media				X				X				X					X	PMU, DOE, CCDC, TRAINER
Project Management	Project coordination and management	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Project coordinator, PMU
	Mobilisation and hiring of personnel	X																	UNDP CO, DOE
	Inception workshop	X																	Project coordinator, PMU
	Progress report		X		X		X		X		X		X		X			X	Project coordinator, PMU
	Annual reports (APR/PIR)				X				X				X					X	Project coordinator, PMU
	Mid term Report									X									International consultant
	Terminal Report																X		International consultant

2. MANAGEMENT ARRANGEMENT

This EEPUC project will provide the Government with a good opportunity to strengthen the institutional, technical and organization capabilities of its agencies in the area of sustainable biomass supply and demand for clean bioenergy, especially at it applies to the residential, institutional and industrial sector (bakery, fish smoking, charcoal production) sector. A prime beneficiary will be the MOE, MAFFS, Forestry Division, CCDC at one learning institute, who will act as key partners, under the tutelage of the Ministry of Energy and Ministry of Trade and Industry. The MOE and CCDC are the best entity for driving this project forward and for establishing a technical competency center in the area of energy efficiency in appliances.

A National Bioenergy Steering Committee will be formed to bring together the key Government ministries and private sector representatives (e.g., producers, retailers, consumers) in order to provide strategic guidance to the PMU and define the priorities of the Bioenergy roadmap and policy and legislation initiative.

The Project Management Unit will be established and hosted within the MoE, will play the key role in project execution. The composition of the PMU and the organizational structure of the Project are given in Figure 5. The PMU will be composed of:

- Project Director
- Project Manager
- Project Assistant
- Technical Experts of Components 1, 2 & 3

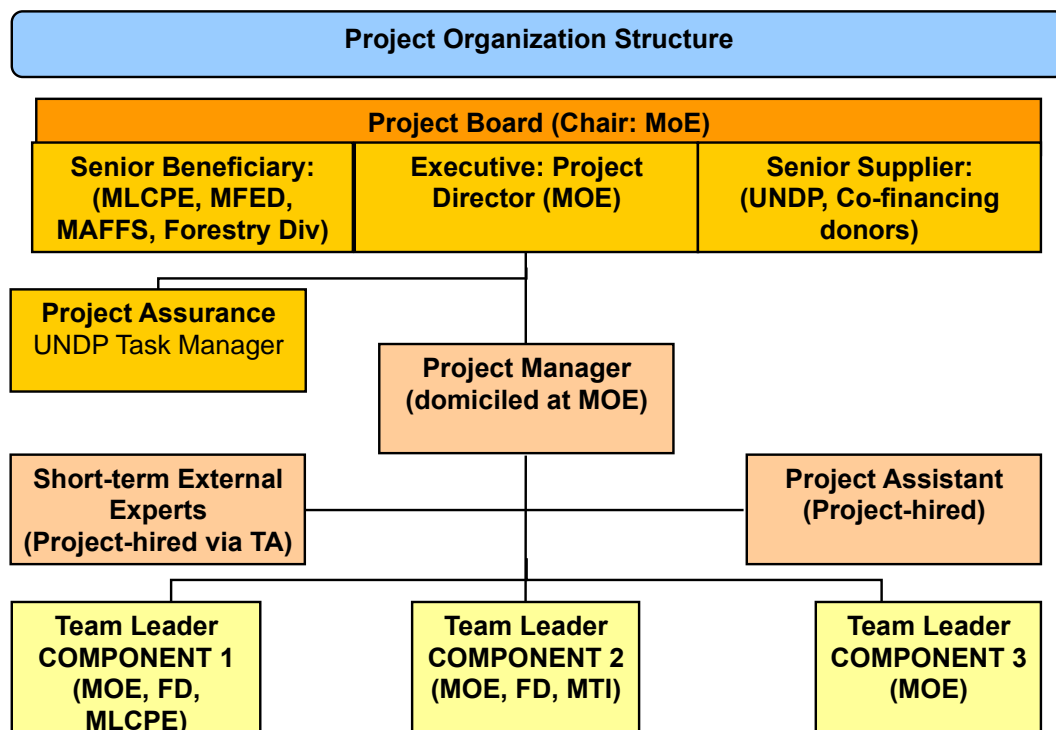


Figure 5: Project Organizational structure

The Project Director (PD) will be responsible for overseeing overall project implementation and ensuring that the project objective and outcomes are achieved in a timely and cost effective manner. The PD will be assisted by the full-time Project Manager (PM) and will report to the Project Board on project progress and plan, and seek its guidance to resolve emerging issues. The PD will provide

guidance to the PM on both strategic and project implementation issues. The PMU will meet regularly for the following functions:

- Provide technical and operational guidance to the Project
- Approve on the quarterly execution plan for the activities of the Project
- Monitor and evaluate the progress of the activities
- Discuss and address technical issues arising during the Project implementation

The project will receive high level guidance and oversight from the **Project Board (PB)**, which will be chaired by the Secretary, Ministry of Energy, as the home ministry for the Lead Executing Agency, MOE. The PB will be responsible for making management decisions on a consensus basis for the Project when guidance is required by the Project Manager, including approval of project revisions. Project assurance reviews will be made by the PB at designated decision points during the running of a project, or as necessary when raised by the Project Manager. The Terms of Reference (TOR) of the PB and of the key personnel of the Project are presented in Annex D of the Project Document.

The Project Board will be responsible for making management decisions for the Project, in particular when guidance is required by the Project Manager. The Project Board will play a critical role in Project monitoring and evaluation by quality assuring these processes and products, and using evaluations for performance improvement, accountability and learning. It will ensure that required resources are committed and will arbitrate on any conflicts within the Project or will negotiate a solution to any problems with external bodies. In addition, it will approve the appointment and responsibilities of the Project Manager and any delegation of its Project Assurance responsibilities. Based on the approved Annual Work Plan, the Project Board can also consider and approve the quarterly plans (if applicable) and also approve any essential deviations from the original plans.

In order to ensure UNDP's ultimate accountability for the project results, Project Board decisions will be made in accordance to standards that shall ensure management for development results, best value for money, fairness, integrity, transparency and effective international competition. In case consensus cannot be reached within the Board, the final decision shall rest with the UNDP's Project Manager.

Potential members of the Project Board will be reviewed and recommended for approval during the UNDP Project Appraisal Committee (PAC) meeting. Representatives of other stakeholders may be included in the Board as appropriate. The Board contains distinct roles, including:

- 1) **The PB Chair:** this will be held by the Director of **MOE**.
- 2) **An Executive:** this will be represented by the **Head of the Renewable Energy Division**, DOE, and Ministry of Energy who will act as the **Project Director**.
- 3) **Senior Supplier:** this will be representatives from **UNDP** and co-financing donors such as the **Cookstove Working Group** and **HWL, EFA, EFO**. The Senior Supplier's primary function within the Board will be to provide guidance regarding the technical feasibility of the project.
- 4) **Senior Beneficiary:** this will be represented by the ultimate beneficiaries of the Project consisting of: **MOE, MFED, MLCPE, MTI** and **MAFFS**. The Senior Beneficiary's primary function within the Board is to ensure the realization of project results from the perspective of project beneficiaries.
- 5) The **Project Assurance** role will be held by a Project-hired **UNDP Task Manager** and will support the Project Board Executive by carrying out objective and independent project oversight and monitoring functions.

Project Manager: The Project Manager, whose TOR is provided in Annex I of the Project Document, will be seconded from the MOE. He/she will have the authority to run the project on a day-to-day basis on behalf of the Implementing Partner within the constraints laid down by the Board. The Project Manager's prime responsibility is to ensure that the project produces the results specified in the project document, to the required standard of quality and within the specified constraints of time and cost.

Project Assistant: A Project Assistant will be hired within the Project and will provide project administration, management and technical support to the Project Manager.

Short-term External Experts: Both international and local short-term experts (STEs) will be engaged to provide technical assistance to support the different activities and aspects of the Project implementation. The selection and hiring of STEs will be done through competitive offers and in accordance with UNDP and the GoSL requirements.

Component Technical Experts: MOE will be in-charge of the Component 1, 3 of the Project, while Components 2 will be co-managed by MOE and MAFFS (FD). The operation of these components will be led by Component Team Leaders provided by these two agencies.

1.11 Monitoring Framework and Evaluation

The project will be monitored through the following M& E activities. The M& E budget is provided in the table below.

Project start:

A Project Inception Workshop will be held within the first 2 months of project start with those with assigned roles in the project organization structure, UNDP country office and where appropriate/feasible regional technical policy and programme advisors as well as other stakeholders. The Inception Workshop is crucial to building ownership for the project results and to plan the first year annual work plan.

The Inception Workshop should address a number of key issues including:

- a) Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and RCU staff vis à vis the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff will be discussed again as needed.
- b) Based on the project results framework and the relevant GEF Tracking Tool if appropriate, finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks.
- c) Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.
- d) Discuss financial reporting procedures and obligations, and arrangements for annual audit.
- e) Plan and schedule Project Board meetings. Roles and responsibilities of all project organisation structures should be clarified and meetings planned. The first Project Board meeting should be held within the first 12 months following the inception workshop.

An Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

Quarterly:

- Progress made shall be monitored in the UNDP Enhanced Results Based Management Platform.
- Based on the initial risk analysis submitted, the risk log shall be regularly updated in ATLAS. Risks become critical when the impact and probability are high. Note that for UNDP GEF projects, all financial risks associated with financial instruments such as revolving funds, microfinance schemes, or capitalization of value chain actors are automatically classified as critical on the basis of their innovative nature (high impact and uncertainty due to no previous experience justifies classification as critical).
- Based on the information recorded in ATLAS, a Project Progress Reports (PPR) can be generated in the Executive Snapshot.
- Other ATLAS logs can be used to monitor issues, lessons learned etc... The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

Annually:

- Annual Project Review/Project Implementation Reports (APR/PIR): This key report is prepared to monitor progress made since project start and in particular for the previous reporting period (1 July to 30 June). The APR/PIR combines both UNDP and GEF reporting requirements.

The APR/PIR includes, but is not limited to, reporting on the following:

- Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets (cumulative)
- Project outputs delivered per project outcome (annual).
- Lesson learned/good practice.
- AWP and other expenditure reports
- Risk and adaptive management
- ATLAS QPR
- Portfolio level indicators (i.e. GEF focal area tracking tools) are used by most focal areas on an annual basis as well.

Periodic Monitoring through site visits:

UNDP CO and the UNDP RCU will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP RCU and will be circulated no less than one month after the visit to the project team and Project Board members.

Mid-term of project cycle:

The project will undergo an independent Mid-Term Evaluation at the mid-point of project implementation (insert date). The Mid-Term Evaluation will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF. The management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Center (ERC). The relevant GEF Focal Area Tracking Tools will also be completed during the mid-term evaluation cycle.

End of Project:

An independent Final Evaluation will take place three months prior to the final Project Board meeting and will be undertaken in accordance with UNDP and GEF guidance. The final evaluation will focus on the delivery of the project's results as initially planned (and as corrected after the mid-term evaluation, if any such correction took place). The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF.

The Terminal Evaluation should also provide recommendations for follow-up activities and requires a management response which should be uploaded to PIMS and to the UNDP Evaluation Office Evaluation Resource Center (ERC).

The relevant GEF Focal Area Tracking Tools will also be completed during the final evaluation. During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

Learning and knowledge sharing:

Results from the project will be disseminated within and beyond the project intervention zone through existing information sharing networks and forums.

The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects.

Finally, there will be a two-way flow of information between this project and other projects of a similar focus.

1.11.1 M & E Workplan and Budget

Type of M&E activity	Responsible Parties	Budget US\$ <i>Excluding project team staff time</i>	Time frame
Inception Workshop and Report	<ul style="list-style-type: none"> ▪ Project Manager ▪ UNDP CO, UNDP GEF 	Indicative cost: 10,000	Within first two months of project start up
Measurement of Means of Verification of project results.	<ul style="list-style-type: none"> ▪ UNDP GEF RTA/Project Manager will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members. 	To be finalized in Inception Phase and Workshop.	Start, mid and end of project (during evaluation cycle) and annually when required.
Measurement of Means of Verification for Project Progress on <i>output and implementation</i>	<ul style="list-style-type: none"> ▪ Oversight by Project Manager ▪ Project team 	To be determined as part of the Annual Work Plan's preparation.	Annually prior to ARR/PIR and to the definition of annual work plans
ARR/PIR	<ul style="list-style-type: none"> ▪ Project manager and team ▪ UNDP CO ▪ UNDP RTA ▪ UNDP EEG 	None	Annually
Periodic status/progress reports	<ul style="list-style-type: none"> ▪ Project manager and team 	None	Quarterly
Mid-term Evaluation	<ul style="list-style-type: none"> ▪ Project manager and team ▪ UNDP CO ▪ UNDP RCU ▪ External Consultants (i.e. evaluation team) 	Indicative cost: USD 20,000	At the mid-point of project implementation.
Final Evaluation	<ul style="list-style-type: none"> ▪ Project manager and team, ▪ UNDP CO ▪ UNDP RCU ▪ External Consultants (i.e. evaluation team) 	Indicative cost: 30,000	At least three months before the end of project implementation
Project Terminal Report	<ul style="list-style-type: none"> ▪ Project manager and team ▪ UNDP CO ▪ local consultant 	0	At least three months before the end of the project
Audit	<ul style="list-style-type: none"> ▪ UNDP CO ▪ Project manager and team 	Indicative cost per year: 3,000	Yearly
Visits to field sites	<ul style="list-style-type: none"> ▪ UNDP CO ▪ UNDP RCU (as appropriate) ▪ The Government representatives 	For GEF supported projects, paid from IA fees and operational budget	Yearly
TOTAL indicative COST Excluding project team staff time and UNDP staff and travel expenses		US\$ 71,500	

Project monitoring and evaluation will be conducted in accordance with established UNDP and GEF procedures and will be provided by the project team and the UNDP Country Office (UNDP-CO) with

support from UNDP/GEF. The Logical Framework Matrix in Annex 1 provides *performance* and *impact* indicators for project implementation along with their corresponding *means of verification*. These will form the basis on which the project's Monitoring and Evaluation system will be built.

The following sections outline the principle components of the Monitoring and Evaluation Plan and indicative cost estimates related to M&E activities. The project's Monitoring and Evaluation Plan will be presented and finalized at the Project's Inception Report following a collective fine-tuning of indicators, means of verification, and the full definition of project staff M&E responsibilities.

1.11.2 Monitoring and Reporting

Project Inception Phase

A Project Inception Workshop will be conducted with the full project team, relevant government counterparts, co-financing partners, the UNDP-CO and representation from the UNDP-GEF Regional Coordinating Unit, as well as UNDP-GEF (HQs) as appropriate.

A fundamental objective of this Inception Workshop will be to assist the project team to understand and take ownership of the project's goals and objectives, as well as finalize preparation of the project's first annual work plan on the basis of the project's log frame matrix. This will include reviewing the logframe (indicators, means of verification, assumptions), imparting additional detail as needed, and on the basis of this exercise finalize the Annual Work Plan (AWP) with precise and measurable performance indicators, and in a manner consistent with the expected outcomes for the project.

Additionally, the purpose and objective of the Inception Workshop (IW) will be to: (i) introduce project staff with the UNDP-GEF *expanded team* which will support the project during its implementation, namely the CO and responsible Regional Coordinating Unit staff; (ii) detail the roles, support services and complementary responsibilities of UNDP-CO and RCU staff vis-à-vis the project team; (iii) provide a detailed overview of UNDP-GEF reporting and monitoring and evaluation (M&E) requirements, with particular emphasis on the Annual Project Implementation Reviews (PIRs) and related documentation, the Annual Project Report (APR), Tripartite Review Meetings, as well as mid-term and final evaluations. Equally, the IW will provide an opportunity to inform the project team on UNDP project related budgetary planning, budget reviews, and mandatory budget rephasings.

The IW will also provide an opportunity for all parties to understand their roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference for project staff and decision-making structures will be discussed again as needed in order to clarify for all, each party's responsibilities during the project's implementation phase.

Monitoring responsibilities and events

A detailed schedule of project reviews meetings will be developed by the project management, in consultation with project implementation partners and stakeholder representatives and incorporated in the Project Inception Report. Such a schedule will include: (i) tentative time frames for Tripartite Reviews, Steering Committee Meetings, (or relevant advisory and/or coordination mechanisms) and (ii) project related Monitoring and Evaluation activities.

Day to day monitoring of implementation progress will be the responsibility of the Project Coordinator, Director or Chief Technical Advisor (depending on the established project structure) based on the project's Annual Work Plan and its indicators. The Project Team will inform the UNDP-CO of any delays or difficulties faced during implementation so that the appropriate support or corrective measures can be adopted in a timely and remedial fashion.

The Project Coordinator and the Project GEF Technical Advisor will fine-tune the progress and performance/impact indicators of the project in consultation with the full project team at the Inception Workshop with support from UNDP-CO and assisted by the UNDP-GEF Regional Coordinating Unit. Specific targets for the first year implementation progress indicators together with their means of verification will be developed at this Workshop. These will be used to assess whether implementation

is proceeding at the intended pace and in the right direction and will form part of the Annual Work Plan. The local implementing agencies will also take part in the Inception Workshop in which a common vision of overall project goals will be established. Targets and indicators for subsequent years would be defined annually as part of the internal evaluation and planning processes undertaken by the project team.

Measurement of impact indicators related to global benefits will occur according to the schedules defined in the Inception Workshop and tentatively listed in the indicative Impact Measurement Template at the end of this Annex. The measurement, of these will be undertaken through subcontracts or retainers with relevant institutions (e.g. vegetation cover via analysis of satellite imagery, or populations of key species through inventories) or through specific studies that are to form part of the projects activities (e.g. measurement carbon benefits from improved efficiency of ovens or through surveys for capacity building efforts) or periodic sampling such as with sedimentation.

Periodic monitoring of implementation progress will be undertaken by the UNDP-CO through quarterly meetings with the project proponent, or more frequent as deemed necessary. This will allow parties to take stock and to troubleshoot any problems pertaining to the project in a timely fashion to ensure smooth implementation of project activities.

UNDP Country Offices and UNDP-GEF RCUs as appropriate, will conduct yearly visits to projects that have field sites, or more often based on an agreed upon schedule to be detailed in the project's Inception Report / Annual Work Plan to assess first hand project progress. Any other member of the Steering Committee can also accompany, as decided by the SC. A Field Visit Report will be prepared by the CO and circulated no less than one month after the visit to the project team, all SC members, and UNDP-GEF.

Annual Monitoring will occur through the **Tripartite Review (TPR)**. This is the highest policy-level meeting of the parties directly involved in the implementation of a project. The project will be subject to Tripartite Review (TPR) at least once every year. The first such meeting will be held within the first twelve months of the start of full implementation. The project proponent will prepare an Annual Project Report (APR) and submit it to UNDP-CO and the UNDP-GEF regional office at least two weeks prior to the TPR for review and comments.

The APR will be used as one of the basic documents for discussions in the TPR meeting. The project proponent will present the APR to the TPR, highlighting policy issues and recommendations for the decision of the TPR participants. The project proponent also informs the participants of any agreement reached by stakeholders during the APR preparation on how to resolve operational issues. Separate reviews of each project outcome may also be conducted if necessary.

Terminal Tripartite Review (TTR)

The terminal tripartite review is held in the last month of project operations. The project proponent is responsible for preparing the Terminal Report and submitting it to UNDP-CO and LAC-GEF's Regional Coordinating Unit. It shall be prepared in draft at least two months in advance of the TTR in order to allow review, and will serve as the basis for discussions in the TTR. The terminal tripartite review considers the implementation of the project as a whole, paying particular attention to whether the project has achieved its stated objectives and contributed to the broader environmental objective. It decides whether any actions are still necessary, particularly in relation to sustainability of project results, and acts as a vehicle through which lessons learnt can be captured to feed into other projects under implementation or formulation.

The TPR has the authority to suspend disbursement if project performance benchmarks are not met. Benchmarks will be developed at the Inception Workshop, based on delivery rates, and qualitative assessments of achievements of outputs.

Project Monitoring Reporting

The Project Coordinator in conjunction with the UNDP-GEF extended team will be responsible for the preparation and submission of the following reports that form part of the monitoring process. Items (a)

through (f) are mandatory and strictly related to monitoring, while (g) through (h) have a broader function and the frequency and nature is project specific to be defined throughout implementation.

i. Inception Report (IR)

A Project Inception Report will be prepared immediately following the Inception Workshop. It will include a detailed First Year/ Annual Work Plan divided in quarterly time-frames detailing the activities and progress indicators that will guide implementation during the first year of the project. This Work Plan would include the dates of specific field visits, support missions from the UNDP-CO or the Regional Coordinating Unit (RCU) or consultants, as well as time-frames for meetings of the project's decision making structures. The Report will also include the detailed project budget for the first full year of implementation, prepared on the basis of the Annual Work Plan, and including any monitoring and evaluation requirements to effectively measure project performance during the targeted 12 months time-frame.

The Inception Report will include a more detailed narrative on the institutional roles, responsibilities, coordinating actions and feedback mechanisms of project related partners. In addition, a section will be included on progress to date on project establishment and start-up activities and an update of any changed external conditions that may affect project implementation.

When finalized the report will be circulated to project counterparts who will be given a period of one calendar month in which to respond with comments or queries. Prior to this circulation of the IR, the UNDP Country Office and UNDP-GEF's Regional Coordinating Unit will review the document.

ii. Annual Project Report (APR)

The APR is a UNDP requirement and part of UNDP's Country Office central oversight, monitoring and project management. It is a self-assessment report by project management to the CO and provides input to the country office reporting process and the ROAR, as well as forming a key input to the Tripartite Project Review. An APR will be prepared on an annual basis prior to the Tripartite Project Review, to reflect progress achieved in meeting the project's Annual Work Plan and assess performance of the project in contributing to intended outcomes through outputs and partnership work.

The format of the APR is flexible but should include the following:

- An analysis of project performance over the reporting period, including outputs produced and, where possible, information on the status of the outcome
- The constraints experienced in the progress towards results and the reasons for these
- The three (at most) major constraints to achievement of results
- AWP, CAE and other expenditure reports (ERP generated)
- Lessons learned
- Clear recommendations for future orientation in addressing key problems in lack of progress

iii. Project Implementation Review (PIR)

The PIR is an annual monitoring process mandated by the GEF. It has become an essential management and monitoring tool for project managers and offers the main vehicle for extracting lessons from ongoing projects. Once the project has been under implementation for a year, a Project Implementation Report must be completed by the CO together with the project. The PIR can be prepared any time during the year (July-June) and ideally prior to the TPR. The PIR should then be discussed in the TPR so that the result would be a PIR that has been agreed upon by the project, the executing agency, UNDP CO and the concerned RC.

The individual PIRs are collected, reviewed and analyzed by the RCs prior to sending them to the focal area clusters at the UNDP/GEF headquarters. The focal area clusters supported by the UNDP/GEF M&E Unit analyze the PIRs by focal area, theme and region for common issues/results and lessons. The TAs and PTAs play a key role in this consolidating analysis.

The focal area PIRs are then discussed in the GEF Interagency Focal Area Task Forces in or around November each year and consolidated reports by focal area are collated by the GEF Independent M&E Unit based on the Task Force findings.

The GEF M&E Unit provides the scope and content of the PIR. In light of the similarities of both APR and PIR, UNDP/GEF has prepared a harmonized format for reference.

iv. Quarterly Progress Reports

Short reports listing main updates in project progress will be provided quarterly to the local UNDP Country Office and the UNDP-GEF regional office by the project team. See format attached.

v. Periodic Thematic Reports

As and when called for by UNDP, UNDP-GEF or the Implementing Partner, the project team will prepare Specific Thematic Reports, focusing on specific issues or areas of activity. The request for a Thematic Report will be provided to the project team in written form by UNDP and will clearly state the issue or activities that need to be reported on. These reports can be used as a form of lessons learnt exercise, specific oversight in key areas, or as troubleshooting exercises to evaluate and overcome obstacles and difficulties encountered. UNDP is requested to minimize its requests for Thematic Reports, and when such are necessary will allow reasonable timeframes for their preparation by the project team.

vi. Project Terminal Report

During the last three months of the project the project team will prepare the Project Terminal Report. This comprehensive report will summarize all activities, achievements and outputs of the Project, lessons learnt, objectives met, or not achieved, structures and systems implemented, etc. and will be the definitive statement of the Project's activities during its lifetime. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the Project's activities.

1.11.3 Independent Evaluation

The project will be subjected to at least two independent external evaluations as follows:-

(i) Mid-term Evaluation

An independent Mid-Term Evaluation will be undertaken at the end of the second year of implementation. The Mid-Term Evaluation will determine progress being made towards the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design, implementation and management. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF.

(ii) Final Evaluation

An independent Final Evaluation will take place three months prior to the terminal tripartite review meeting, and will focus on the same issues as the mid-term evaluation. The final evaluation will also look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental goals. The Final Evaluation should also provide recommendations for follow-up activities. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit and UNDP-GEF.

(iii) Audit Clause

Audit will be conducted according to UNDP Financial Regulations and Rules and applicable Audit policies.

1.11.4 Learning and Knowledge Sharing

Results from the project will be disseminated within and beyond the project intervention zone through a number of existing information sharing networks and forums. In addition:

- The project will participate, as relevant and appropriate, in UNDP/GEF sponsored networks, organized for Senior Personnel working on projects that share common characteristics. UNDP/GEF shall establish a number of networks, such as Integrated Ecosystem Management, eco-tourism, co-management, etc., that will largely function on the basis of an electronic platform.
- The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned.

The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Identify and analyzing lessons learned is an on-going process, and the need to communicate such lessons as one of the project's central contributions is a requirement to be delivered not less frequently than once every 12 months. UNDP/GEF shall provide a format and assist the project team in categorizing, documenting and reporting on lessons learned. To this end a percentage of project resources will need to be allocated for these activities.

3. LEGAL CONTEXT

This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together a Project Document as referred to in the Standard Basic Assistance Agreement (SBAA) and all CPAP provisions apply to this document.

Consistent with the Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.

The implementing partner shall:

- put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
- assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP/GEF hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via <http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm>. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

The UNDP Resident Representative in Sierra Leone is authorized to effect in writing the following types of revision to this Project Document, provided that he/she has verified the agreement thereto by the UNDP Regional Coordination Unit and is assured that the other signatories to the Project Document have no objection to the proposed changes:

- Revision of, or addition to, any of the annexes to the Project Document;
- Revisions which do not involve significant changes in the immediate objectives, outputs or activities of the project, but are caused by the rearrangement of the inputs already agreed to or by cost increases due to inflation;
- Mandatory annual revisions which re-phase the delivery of agreed project inputs or increased expert or other costs due to inflation or take into account agency expenditure flexibility; and
- Inclusion of additional annexes and attachments only as set out here in this Project Document

Standard text has been inserted in the template. It should be noted that although there is no specific statement on the responsibility for the safety and security of the executing agency in the SBAA and the supplemental provisions, the second paragraph of the inserted text should read in line with the statement as specified in SBAA and the supplemental provision, i.e. "the Parties may agree that an Executing Agency shall assume primary responsibility for execution of a project."

If the country has signed the [Standard Basic Assistance Agreement \(SBAA\)](#), the following standard text must be quoted:

This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together a Project Document as referred to in the SBAA [or other appropriate governing agreement] and all CPAP provisions apply to this document.

Consistent with the Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.

The implementing partner shall:

- a) put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
- b) Assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via <http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm>. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

If the country has not signed the SBAA, the following standard text must be quoted:

This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together the instrument envisaged in the [Supplemental Provisions](#) to the Project Document, attached hereto.

Consistent with the above Supplemental Provisions, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner.

The implementing partner shall:

- a) put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
- b) Assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via <http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm>. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

The following standard text for a global/ multi country and regional projects should be included:

This project forms part of an overall programmatic framework under which several separate associated country level activities will be implemented. When assistance and support services are provided from this Project to the associated country level activities, this document shall be the "Project Document" instrument referred to in: (i) the respective signed SBAs for the specific countries; or (ii) in the [Supplemental Provisions](#) attached to the Project Document in cases where the recipient country has not signed an SBAA with UNDP, attached hereto and forming an integral part hereof.

This project will be implemented by the agency (name of agency) ("Implementing Partner") in accordance with its financial regulations, rules, practices and procedures only to the extent that they do not contravene the principles of the Financial Regulations and Rules of UNDP. Where the financial governance of an Implementing Partner does not provide the required guidance to ensure best value for money, fairness, integrity, transparency, and effective international competition, the financial governance of UNDP shall apply.

The responsibility for the safety and security of the Implementing Partner and its personnel and property, and of UNDP's property in the Implementing Partner's custody, rests with the Implementing Partner. The Implementing Partner shall: (a) put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being

carried; (b) assume all risks and liabilities related to the Implementing Partner's security, and the full implementation of the security plan. UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

The Implementing Partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via <http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm>. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

4. ANNEXES

ANNEX A: BASELINE AND INCREMENTAL ACTIVITIES

Appendix A: Baseline and Incremental Activities			
Outcome	Output	Baseline Activity	Incremental Activity
<p>Outcome 1. Strengthened institutional capacity on biomass resource utilization at the national, regional and community level</p> <p>Operational effective policy, legal, and regulatory frameworks and review mechanisms on biomass energy technology applications</p>	<p>Output 1.1 Adequately trained and capable decision-makers and relevant stakeholders (from EPA-SL, ministries, private sector, rural communities, etc.) leading efforts, communicating and managing more efficiently produced charcoal and improved cookstove utilization in an integrated manner</p>	<p>The institutional arrangements and institutional capacities of SLEPA are currently being strengthened through the “Technical Assistance and Capacity Building Project for SLEPA” (SLEPA1 project).</p> <p>Synergies will be sought with the relevant on-going EU funded projects, namely in the field of climate change, forest conservation and, to a lesser extent, in the agriculture and food security sector. Of particular importance is the coherence with the on-going €1 million “<i>Technical Assistance and Capacity Building Project for SLEPA</i>” (SLEPA1 Project; timeframe 2009-2012) and the future €4 million “<i>Environmental Governance and Mainstreaming</i>” (SLEPA2 Project; timeframe: 2011-2017), which will support the setting up of the National Secretariat for Climate Change (NSCC).</p> <p>EUEI-PDF has developed an Household Energy Roadmap. Part of the programme is to raise awareness and enlighten the public stakeholders in developing sustainable charcoal business as a stop-gap solution in accessing modern energy services (LPG, bioethanol, electricity).</p>	<p>Creation, establishment and operation of Research, Knowledge, Learning and Coordination Center (RKLCC) at DOE as a Center of Excellence to collect, coordinate and monitor the biomass resources and to champion the promotion of sustainable certified charcoal and improved cookstove business</p> <p>Preparation work and organization of training on efficient charcoal production and utilization</p> <p>Conduct of training on efficient charcoal production and utilization by an International Expert to sensitize public, private and CSO stakeholders</p>
	<p>Output 1.2 Formulated, approved and enforced policies, laws and regulations on more efficient charcoal production and utilization through improved cookstove</p>	<p>The EUEI-PDF’s Household Energy Roadmap sets out policies with potential interventions to improve sustainability in the biomass sector (e.g., counter forest degradation and indoor air pollution).</p> <p>Implementation of the National Energy Policy and National Energy Strategy (2009) by the GoSL.</p> <p>Operation of the GoSL-</p>	<p>Provision of technical assistance for securing the support of the program as part and parcel of the National Energy Policy and National Energy Strategy (2009), including the conduct of advocacy activities to generate buy in for the approval and implementation of these policies and regulations, and to build investor and end user confidence and to leverage private sector resources.</p> <p>This will also involve the following activities:</p> <ul style="list-style-type: none"> • Design and implementation of an improved cook stoves (ICS) and efficient charcoal production standards, testing and certification (STC) program • Monitoring of the implementation of these

		<p>supported DOE as the Centre of Excellence and champion of bioenergy development and promotion in Sierra Leone.</p> <p>Proposed national cook stove baseline and market assessment by GERES and GACC</p> <p>Implementation of the National Forestry Policy (2010) by the GoSL with helps from ICRAF's BioDev, EU-REDD+, USAID's CARE and BioClimate for sustainable production and efficient utilization of fuel wood.</p> <p>EUEI PDF has assisted MOE to develop the Household Cooking Energy Roadmap (2013) that is yet to be endorsed and implemented.</p>	<p>policy instruments, where appropriate, provision of support to make the implementation more effective.</p> <p>Preparation of detailed regulatory frameworks, containing regulations, procedures, standards and incentives for the smooth and effective implementation of biomass energy applications</p>
	<p>Output 1.3 Developed standards and certification for more efficient charcoal and improved cookstove production</p>	<p>There are different types of charcoal and fuel wood cookstoves in the market but none of these appliances have been tested nor certified in Sierra Leone. There is no testing facility hence no standard and label developed on cooking appliances in Sierra Leone.</p> <p>The quality and efficiency of their liners have not been tested. Such testing, not just for their stoves, but for other charcoal (and wood) stoves would give consumers confidence in the product and, if their quality of production is as good as it appears, could help them compete better in the market. This GEF funded project with other partners seeks to develop a vibrant improved cookstoves business as a cost effective means to charcoal demand (by as much as 50%) and GHG emissions.</p>	<p>The Standard, Testing and Certification ordinance will be developed within the National Energy Policy and Strategy (2009) and acquired legal status.</p> <p>In partnership with GERES and ECREEE, producers association and end users, this output will train, install and operate basic laboratory facilities, instrumentation and measuring devices for the continuous improvement in the design of stoves and kilns based on results of the monitoring and evaluation activities as well as consumer feedback.</p> <p>Select institution in which the Charcoal and Cookstove Development Center (CCDC) will be located</p> <p>Set-up cookstove testing laboratory in CCDC</p> <p>Develop standard from fuel-efficiency and emissions testing of all existing cookstoves in Sierra Leone – select three prototypes for scale up</p> <p>Facilitate iterative design improvements and strategic new stove designs by the CCDC</p>
<p>Outcome 2. Increased number of</p>	<p>Output 2.1 Established partnerships</p>	<p>Continuous efforts of the GoSL for greater public private and CBO partnership</p>	<p>This output will build on the strong entrepreneurial ship of the Sierra Leonean champions/diasporas and the vibrant dynamism of the Charcoal</p>

<p>investments on improved, more efficient charcoal and ICS production in Sierra Leone</p>	<p>between the public and private stakeholders involved in the value chain of charcoal production and utilization</p>	<p>to bring inclusive and equitable growth and development.</p> <p>NGO-, and CBO-led community programs on livelihood improvement to bring sustainable development to the local level.</p>	<p>Producer Associations, the interest of local governments and chiefs, the interest of Central Government to develop successful and viable biomass business for national replications.</p> <p>Identification of roles of community-based organizations in the promotion and deployment of sustainable biomass energy in the country</p> <p>Agreement on modalities and incentives for CBO participation in the sustainable biomass energy promotion and deployment</p> <p>Development and implementation of mechanisms for incentivizing CBOs more effective participation in the deployment of renewable biomass energy.</p>
		<p>GoSL's inclusive growth program (also targeting youths and women) on innovative business support initiatives and for training social entrepreneurs in the micro, small and medium enterprise sectors.</p> <p>BRAC offers of financial products and services for social businesses.</p> <p>UNDP's Business Development Service (BDS) and Agribusiness Services Programme:</p> <p>i. Business Development Services: The objectives of the BDS project is to operationalize business development services in different locations in creating self-employment opportunities for 250 youths as part of the Youth Employment & Empowerment Programme.</p> <p>ii. Sierra Leone Agri-business Service Initiatives (SABI): The Sierra Leone Agri-Business Initiative (SABI) Project seeks to transform the agricultural value chain, boost the attractiveness of the agricultural sector to youth entrepreneurs in urban and rural communities and create greater employment opportunities nationwide.</p>	<p>Reviewed international, regional and national lessons learnt in the financing and scaling up of more efficiently produced charcoal and ICS production</p> <p>In partnership with Ministry of Finance and Economic Development, MFIs, MOE and UNDP's BDS and SABI programmes, establish procedures, implementing arrangement, oversight and modalities for the implementation of startup grant and end user rebate scheme</p> <p>Implementation of financing schemes and incentives for scaling up of efficient charcoal kilns and improved cookstove business</p> <p>Design and implementation of the loan risk guarantee funding scheme for scaling up of efficient charcoal kilns and improved cookstove business</p>

	<p>Output 2.3: Implemented and operational i) 300 locally produced industrial stoves for income generating local enterprises such as fish smoking, bakery, gari processing and tobacco curing and ii) 700 institutional stoves for school, prisons and hospitals.</p>	<p>Expanded GoSL investments in the cottage industry sector for employment creation for youth and women.</p> <p>Assistance program under the Ministry of Trade and Industry in developing new business and technical skills for local entrepreneurs.</p> <p>GoSL program on the adoption of good practices on safety, health and environment to promote energy efficient systems with safe, healthy and hygienic working conditions.</p>	<p>This output seeks to green up the value chain of the cottage industry and institutional sector to provide cleaner, safer and more hygienic working conditions whilst creating green jobs.</p> <p>Identification of local producers/fabricators, raw material suppliers and micro-entrepreneurs and their specific areas of involvement in the micro and small enterprise industrial cook stoves program</p> <p>Investigation and formulation of appropriate procurement procedures, cost sharing schemes and market delivery mechanisms</p> <p>Implementation of public-private partnerships and start up grant and loan guarantee scheme for the production & delivery of energy efficient stoves/furnaces/kiln</p>
	<p>Output 2.4: Implemented and operational 1,000 locally produced efficient kilns for the sustainable production of certified charcoal.</p>	<p>The recent EUEI-PDF Household Energy Roadmap (2013) recommends to the GoSL to develop viable sustainable forest energy enterprises to test business model for sustainable charcoal production.</p> <p>Implementation of a community-based sustainable woodlots and harvesting under ICRAF and EU REDD+ programmes:</p> <p>i. ICRAF's WP1.4: To improve fuelwood use efficiency and develop sustainable wood energy systems</p> <p>ii. EU-REDD+:</p> <p>Expected Result 4: Sustainable charcoal production is piloted in Sierra Leone, showing its potential to reduce the pressure on forests.</p> <p>4.1. Analysis of the economics and dynamics of charcoal production and consumption in Sierra Leone.</p> <p>4.2. Definition and agreement of a strategy to pilot sustainable charcoal production, including identification of a charcoal production area to pilot the strategy, and implementation of pilot projects</p>	<p>Whilst ICRAF and EU-REDD+ focus on the supply side, in partnership with FD, this output will focus on demand side management to improve efficiency as inclusive business to align the interests of all value chain actors for ensuring commercially viable production of certified charcoal on a sustainable basis.</p> <p>Identification of local producers/artisans, raw material suppliers and micro-entrepreneurs and their specific areas of involvement</p> <p>Investigation and formulation of appropriate procurement procedures, cost sharing schemes (startup grant and loan guarantee scheme) and market delivery mechanisms</p> <p>Implementation of public-private partnerships for the development of the sustainable certified charcoal business for wider replications</p> <p>Conduct of training and awareness campaign on the use, maintenance and benefits of energy-efficient kilns</p> <p>Regular monitoring and evaluation of installed kilns</p> <p>Improvement in the design based on results of the monitoring and evaluation activities</p> <p>Promotion and replication of re-designed kilns to remaining producers</p>

	<p>Output 2.5: Implemented and operational locally produced 14,000 energy efficient and certified cookstoves for households</p>	<p>West Wind Energy and Bockarie are pioneers of the Jiko stoves adopted from Kenya.</p> <p>Informal ICS business and lack organization to take advantage of bulk order and networking.</p> <p>Over 100 villagers produce liners that are in high demand in Freetown, and even in Liberia and Guinea. It is one of the most important sources of livelihood in the area. They cooperate and train one another, but, they lack the organization as an association to finance expansion or to organize transport, or to take the initiative to place their goods at the best prices in their markets in order to increase their share of the value of final stove sales.</p> <p>ICRAF WP1.4: To improve fuelwood use efficiency and develop sustainable wood energy systems</p>	<p>Although promotion of clean and efficient cooking solutions to reduce the demand for non-renewable fuel wood and indoor air pollution whilst reducing GHG and black carbon emissions are part of the National Energy Policy and Energy Strategy (2009), efforts have been lacking, piecemeal and coordinated.</p> <p>This GEF funded project with other partners seeks to develop a vibrant improved cookstoves business as a cost effective means to reduce charcoal demand (by as much as 50%) and GHG emissions.</p> <p>Expansion and improvement of the existing WestWind's WonderStove, Bockarie ICS business model as for national scaling up to the 13 districts of the country.</p> <p>Design and local fabrication of the domestic and institutional stoves and training on their design and operation features</p> <p>Production, installation and dissemination of furnaces/stoves to end-users using start up grant and end user rebate</p> <p>Conduct of training and awareness campaign on the use, maintenance and benefits of energy-efficient furnaces/stoves</p> <p>Regular monitoring and evaluation of installed furnaces/ stoves</p> <p>Improvement in the design based on results of the monitoring and evaluation activities. There will be continuous assessment and feedback on the performance of the improved cook stoves – household, institutional and industrial, construction procedures and manual of stoves.</p> <p>Promotion and replication of re-designed furnaces/stoves to remaining households and community-based institutions</p> <p>Development of the necessary platform for the scale-up and sustainability of the GEF project beyond its project-life, including promoting a livelihood support program to expand the productive use of biomass energy.</p>
	<p>Output 2.6 Established and operationalized framework for the phase-out of traditional cook stoves</p>	<p>There is no framework established for the phasing out of the traditional cookstove and charcoal production.</p>	<p>This output seeks to develop a Monitoring Verification and Enforcement (MVE) programme for the phasing out of the obsolete technology through robust monitoring, marketing, technology improvement and campaign to cause a tipping point.</p> <p>Instead of relying on regulatory enforcement that</p>

			<p>can be expensive, PTD will help to improve design that meet the needs of the end users whilst reducing the price of appliances through bulk order and efficient production and the enabling environment will spur private sector investment to scale up production.</p> <p>The carbon finance option such as Programme of Activities or NAMA could provide a framework for the phasing out of traditional cookstove and charcoal production as a stop gap solution to accessing modern energy services</p>
<p>Outcome 3. The production and utilization of certified charcoal and certified improved cook stoves are common practices in Sierra Leone</p> <p>Enhanced capacity of stakeholder in the value chain (producers, farmers, villagers, women, consumers, collectors)</p>	<p>Output 3.1. Developed gender sensitive capacity development and modules for the production and utilization of certified charcoal and ICS</p>	<p>There are limited knowledge products and training modules for the production and utilization of certified charcoal and certified ICS in SL.</p>	<p>The scaling up project to be developed under Output 2,3, 2,4 and 2,5 will be monitored and documented carefully by the CCDC. One consultant will be hired specifically to undertake the monitoring and evaluation to develop case studies, with extensive examples, to be used to provide working models, gender sensitive knowledge products and training modules for other similar enterprises to replicate throughout Sierra Leone.</p> <p>Documentation, regular production and dissemination of information related to biomass energy resources and bioenergy technologies application and utilization</p>
	<p>Output 3.2 Developed and implemented promotional schemes on the social, economic and environmental co-benefits of improved charcoal and improved cook stoves to generate good buy-in and willingness to pay</p>	<p>There is limited promotional scheme and materials to promote the co-benefits of clean charcoal and ICS in SL.</p> <p>Promotion is unorganized and through word of mouth.</p> <p>The EUEI-PDF has developed a HH Energy Roadmap to promote the awareness on the benefits of using clean charcoal and ICS.</p>	<p>In partnership with GERES, WACCA and ICRAF, this output will develop promotional and marketing materials to inform end users on the cost benefits of using clean charcoal and ICS products.</p> <p>Development and operationalization of a market information system to stimulate the market through public awareness and advertising campaigns to promote the use of clean/cleaner technologies.</p>
	<p>Output 3.3 Sensitized key value chain actors through public awareness campaign and capacity development</p>	<p>There is limited training and capacity development programme to enlighten the value chains on the benefits of using clean technology.</p> <p>UNDP's Social Business Training Programme</p> <p>The EUEI-PDF Roadmap recommends to develop campaign so the end users can make informed decision in the purchase of clean technology.</p>	<p>This output will utilize the knowledge products and training modules developed under Output 3.1 to sensitize and enhance the capacity of the public, private, CSOs and CBOs and value chain actors in the production, distribution, marketing and maintenance of clean technology.</p> <p>Preparation, organization and conduct of training on integrated rural energy planning and biomass resource assessment</p> <p>Conduct of skills-based training on EE & RE, environmentally friendly construction and business skills, facilitating the setting up of the knowledge network & solutions exchange, advising on the</p>

			<p>operation and management of the learning center as well as extend training coordinators & facilitation.</p> <p>Preparation work and organization of training on different aspects of bioenergy technologies building on the experience of the UNDP's Social business training program.</p> <p>Conduct of training on different aspects of bioenergy technologies, including industrial stoves and kilns systems</p> <p>Preparation work and organization of training on the installation, operation and maintenance of energy-efficient furnaces/stoves/kilns</p> <p>Conduct of training on the design, installation, operation and maintenance of energy-efficient furnaces/stoves/kilns</p>
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ANNEX B: STAKEHOLDER GROUPS AND THEIR PARTICIPATION

A description of the public, private and CSO stakeholder groups and their involvement in the Project as well as the benefits they can expect to receive:

Division of Energy (DOE), Ministry of Energy: DOE was established by an act in 2010 under the Ministry of Energy. The DOE was set up to conduct strategic planning on energy security and access issues and was mandated to introduce new energy resources and ensure efficient utilization of energy resources. To further implement its objective, the DOE formed the Renewable Energy and Alternative Energy unit in 2012 to address the issues of renewable energy and energy efficiency. The unit is charged with the responsibility of organizing and conducting research and development in renewable energy and energy efficiency and conservation. It is also expected to train public and private and CSO stakeholders and students in areas round climate change and RE and EE.

Environmental Protection Agency (SLEPA), GEF Focal Point: SLEPA has been receiving support from EU to enhance their mitigation capacity. This GEF funded project will add incremental value to compliment EU initiative to mainstream climate mitigation solutions into national development agenda. The GEF funded project will help to enhance the capacity of the Climate Change Unit and DNA to explore the feasibility to develop carbon project to leverage carbon finance. The Chairperson of SLEPA reminded the team to explore the feasibility to develop sustainable supply of feedstock through community woodlot as an output to compliment the demand for efficient cookstove and charcoal. The team will work closely with SLEPA in the designing of the GEF funded project and work to enhance their capacity in the coordination and networking of clean technology and to develop baseline data inventory monitoring system. The outputs are in line with the mitigation strategy of the SNC and help in defining Third NC.

Ministry of Trade and Industry: The Ministry suggested that the GEF project should explore the feasibility to green up the value chain of the cottage industry that utilize large amount of firewood such as tobacco curing, fish smoking, cassava gari production, bakery and brick/ceramic production. The GEF project will work closely with the Ministry to enhance their clean credential and green technical capacity. As there is no directory being established on the number of enterprises and the project will help to establish a directory on the number of microenterprises, volume of firewood used and monitors the GHG savings from this sector.

Forestry Division (FD) is under the Ministry of Agriculture, Forestry and Food Security. The GEF funded project will partner with FD to promote micro-nursery and community forestry through tree replanting and Farmers Managed Agroforestry to ensure that there is sustainable supply of renewable biomass that will alleviate the pressure on natural forests. This GEF funded project will work closely with the EU's REDD+ project. There is still a need to ascertain as to the forest cover and deforestation rate of SL. This GEF funded project will work closely with the Forestry Division in the design and implementation of the GEF and will compliment EU's and development partners' forestry project to enhance the capacity of the Forestry experts at the national, district, Chiefdom and village level.

Ministry of Local Government and Rural Development: It's mission is to design, implement, coordinate and evaluate the policies in the area and it is also committed to ensuring access of the citizens to professional training, enabling everyone to acquire and constantly update knowledge and skills to enter and / or remain working.

UNDP's Business Development Service (BDS) and Agribusiness Services Programme:

i. Business Development Services: The objectives of the BDS project is to operationalize business development services in different locations in creating self-employment opportunities for 250 youths as part of the Youth Employment & Empowerment Programme.

ii. Sierra Leone Agri-business Service Initiatives (SABI): The Sierra Leone Agri-Business Initiative (SABI) Project is a joint initiative between the GoSL, UNDP, FAO and UNIDO, modeled after the SONGHAI Centre in Benin, that seeks to transform the agricultural value chain, boost the attractiveness of the agricultural sector to youth entrepreneurs in urban and rural communities and create greater employment opportunities nationwide. A part of the USD 1.2 million could be listed as

co-funding as there is potential to work together to develop and train youth and graduates as new business to scale up clean technology in greening up the value chain of the cottage industry. The BDS and SABI will compliment Component 2 of the GEF funded project.

Micro-Finance Institution: BRAC is the largest MFI in Sierra Leone and has set up 36 branches within the last 2 years. But BRAC has shared of the challenges in developing viable MFI business in Sierra Leone due to high operation cost. Repayment is very high but there are some issues in getting trustworthy qualified graduate. BRAC offers two types of loan – small enterprise loan with loan of between USD 2,000 to 6,000 and small micro loan. Interests are charged at 25% and 30% for shorter loan. As BRAC has been receiving UNCDF funding, BRAC is keen to explore with UNDP on how loan products and services could be designed and used to scale up charcoal and cookstove production.

World Food Program (WFP): WFP has been operational in Sierra Leone since 1968. WFP operates in the Southern, Northern, Eastern and Western regions with an office in Freetown and one sub-office located in Kenema. In collaboration with the GoSL and other partners, WFP pursues the goal of feeding the hungry poor by supporting reconstruction and rehabilitation following the devastating civil war in the 1990s. In 2011, WFP reached 696,271 vulnerable people across Sierra Leone with 15,800 million tons of food.

Renewable Energy Centre (REC), Government Technical Institute, Freetown: Set up in 1964, the institute has about 3,000 students doing 3 years diploma courses in various technical disciplines. The center has gathered some experience in developing solar, hydro and biogas technology. The institute is partnering with ECREEE on RE and EE projects. This project will partner with REC to strengthen their technical and financial capacity and explored the potential to develop REC as a Centre of Excellence in RE. REC could be a potential candidate institution for the setting up of the Cookstove and Charcoal Development Center (CCDC) for the testing and certification program with support from Aprovecho.

ECOWAS Renewable Energy and Energy Efficiency Center, Cape Verde (ECREEE): ECREEE as ECOWAS' Center of Excellence is established to enhance regulatory, financial and technical capacity of ECOWAS members in formulating REEE policy and strategy. This GEF funded project will work closely with ECREEE's West African Clean Cookstove Alliance (WACCA) initiative to strengthen their support in Sierra Leone especially in the development and harmonization of standard and label for cookstove. WACCA is helping to establish cookstove testing centers in Senegal and Ghana.

WestWind Energy: The founder of WonderStove was the pioneer who started to introduce the Kenyan charcoal stove in 1989. WonderStove had trained many early workers who have started their own production. WonderStove provides a 6 months guarantee and provide repair after the warranty has expired. They produced his own clay liner and contract out some of the production. WonderStove is concern that there is proliferation of inferior stoves that use inferior clay as liner.

Toyola Energy: Toyola Energy Limited started producing and distributing energy efficient charcoal stoves for domestic users in the urban and rural parts of Ghana and is now seeking to expand their business model to Sierra Leone. Toyola have implemented an innovative business model that includes the poor along the whole value chain as suppliers, manufacturers, retailers and customers and accounts for positive economic, social and environmental effects.

Bockarie Kargbo at Lunsar: Started making cookstove liner and cookstove in 1993 and had trained other apprentice. Bockarie used the clay from his site to make liner as well as brick and compressed blocks. The owner is one of the pioneers who has partner with WonderStove to introduce the stove from Kenya. Access to high quality clay is critical for making the durable liners for the stove as well as for making high quality brick with high refractive properties. As a pioneer and given his excellent factory space, Bockarie has the potential to act as trainer and to produce liners for the 15,000 stoves.

Charcoal Producers Association (CPA): CPA serves its members through advocacy and dialogue with government on policy and regulatory issues as well as help to promote the safe and sustainable production and use of charcoal. This GEF funded project will partner with CPA to strengthen their capacity and to promote the use of efficient kilns and sustainable supply of fuelwood for charcoal production.

Environmental Foundation of Africa (EFA): EFA is currently conducting a household energy usage survey as part of the DFID funded CKDN project 'Renewable Energy Empowerment in Rural Sierra Leone: A Vision to Electrify Rural Sierra Leone'. Tommy will send the survey data to the team that will be used in the GEF funded project. A new training center is being built. Given their experience with working with local community and beneficiaries, this GEF funded project will work closely with EFA in the scaling up of kiln and cookstove as inclusive business.

International Center for Research in Agroforestry (ICRAF): The World Agroforestry Centre (ICRAF) in Sierra Leone support the 'Building Biocarbon and Rural Development in West Africa Project (BIODEV)'. BIODEV will operate in Guinea, Mali and Sierra Leone to demonstrate development and environmental benefits from undertaking a "high value biocarbon approach" across large landscapes. The four-year project, implemented in partnership with the Center for International Forestry Research (CIFOR) and regional and international universities, is funded by the Government of Finland. The expected outcomes are: More diversified livelihoods – many households will have planted or regenerated new trees and developed new value adding enterprises; Higher incomes from farms and forests, and rangelands: through strengthened linkages between farmers and markets for tree and forest products they already produce; Rural villages and households in Sierra Leone who will benefit from: improved agro-forestry and other agricultural innovations for climate change adaptation and mitigation, improved forest management options, enhanced adaptive capacity and hopefully improved access to carbon finance; Improved forest, tree and vegetation cover, and biodiversity (and reduced deforestation): through increased tree planning and forest management; National development, policy and research organizations, either as formal national partners receiving and managing funds, or as strict beneficiaries; Increased level of carbon sequestered. This GEF funded project look forward to working with ICRAF to develop sustainable rural development intervention for securing food and bioenergy access.

EU Energy Initiative Partnership Dialogue Facility (EUEI-PDF): EUEI PDF has received a request from the Ministry of Energy of Sierra Leone to assist with the formulation of a Household Cooking Energy Plan. This action will form an essential first preparatory step in the development of a comprehensive Household Cooking Energy Plan for Sierra Leone and will build on the scoping study that EUEI-PDF has undertaken in 2011 with the Ministry of Energy. The project is to be carried out under the framework of the Africa-EU Renewable Energy Cooperation Project (RECP). The results are also expected to be of significance to the roll-out of Sustainable Energy for All initiative (SE4All) within Sierra Leone. The Project began in early-2013 and comprised two phases. Phase 1 (January to July 2013) comprised stakeholder engagement, extensive interviewing, some data collection and regional (provincial) and national stakeholder consultations. Phase 2 (August to October 2013) consisted primarily of extensive discussions with key Government, Parliamentarian, development partner, and non-governmental organization (NGO) and community-based organization (CBO) stakeholders.

Welthungerhilfe (WHL): WHL started its engagement in Sierra Leone in 2003. Since then, around 20 projects with a total amount of approximately €35 Million (co-financed by EC, BMZ, GIZ, DfID UK, ECREEE), University of Wuppertal, FAO) working on: WASH, agricultural development, income generation for disadvantaged population. WHL is the implementer of the WAPFR project of which the 'Reduction of fire wood for fish-conservation industry (fish-smoking) in Western Area Peninsula' is part of the WAPFR project.

WAPFR (Conservation of the Western Area Peninsula Forest Reserve) and its Watersheds: WAPFR is a Government project, funded by EU, and its overall objective is to introduce participatory processes in decision making on the sustainable use of natural resources that contribute to the reduction of rural poverty in the Western Area Peninsula and to conserve and sustainably manage the Sierra Leonean Western Area Peninsula Forest Reserve (WAPFR) and its watershed. This project also intends to build a new and final boundary of the forest reserve with an official enforcement of this boundary. The WAPFR is implemented by EPA-SL (Environment Protection Agency – Sierra Leone) and has a \$3 million budget and its implementation period is 2009 - 2014. The proposed GEF funded project seeks to add incremental value to the activities under this project in order to generate significant global environmental benefits, one of which is ensuring that charcoal production is not leading to continuous deforestation.

GERES (GERES): Through the StovePlus program and in collaboration with GACC, GERES is providing technical support to project developers in West Africa in the areas of: baseline assessments, market study, improve cookstove production, demand creation and testing. This GEF funded project look forward to working with GERES in scaling up improved cookstove in Sierra Leone.

CARE: CARE UK is working with USAID in Northern Sierra Leone and Guinea on the STEWARD¹⁵ forestry project. They are working with a number of communities on improved land use management and agriculture.

BioClimate is based out of Edinburgh, Scotland, with an active team of Sierra Leoneans working on sustainable forest management, supported by the STEWARD Project. They focus on payment for environmental services (PES) for improved forestry and land use management using the Plan Vivo carbon management approach.

Regional Collaboration Center (RCC), UNFCCC: In order to address the under representation of CDM projects/programs in LDC, RCC in Lome, Togo is tasked to provide financial and technical support to strengthen the capacity of the DNAs and project developers in West Africa for meeting CDM requirements. In collaboration with UNDP MDG carbon, this GEF funded project will seek to develop the improved cookstove and charcoal kilns programs as bankable and verifiable carbon project. MDG Carbon and RCC will help to look for potential investors in these two programs.

Food and Agriculture Organization (FAO): FAO has developed the Bioenergy and Food Security (BEFS) Approach for Sierra Leone that seeks to assist policy-makers in assessing the interplay between natural resource availability, bioenergy production potential, rural development and food security, and in strengthening their capacity to manage the trade-offs associated with bioenergy development.

Energy for Opportunity (EFO): EFO is a national NGO that was established in 2005. The organization is currently operating in six districts in the country focusing on energy, sanitation, clean water, health promotion and agriculture. EFO has 25 permanent staff with extensive experience in community mobilization, battery charging, clean water projects, and community energy projects, including carrying out fuel wood trade, energy assessments and surveys, solar capacity design, installation and training.

Aprovecho Research Center (ARC) is a non-profit corporation established in 1976 and it is dedicated to researching, developing and disseminating appropriate technological solutions for meeting the basic human needs of refugees and impoverished people and communities in the developing world. This GEF funded project will explore the feasibility to partner with ARC to set up stove testing labs in Sierra Leone in collaboration with regional ECREEE in Cape Verde.

Consumers: The consumers especially women will be important beneficiaries of the bioenergy program, as they will be able to reduce the share that energy represents in household budgets. However, given the relative lack of knowledge of many buyers in Sierra Leone, an information and outreach campaign will be needed to explain the value of considering the total cost of ownership before making an appliance purchase.

University of Njala, Freetown: is the major institution of higher education in the country. The Department of Community Development leads local researchers and supervises the data collection and analysis on community development in the country.

EFA: The Environmental Foundation for Africa (EFA) “aims to protect and restore the environment in West Africa. It has been active in Sierra Leone for over 15 years. EFA leads environmental education and awareness raising campaigns, restores degraded lands and conserves forests, minimizes the impacts of civil war on the environment and its inhabitants, and equipped thousands of people with sustainable livelihood skills such as agroforestry.”

¹⁵ *Sustainable and Thriving Environments for West African Regional Development (STEWARD) is funded by USAID and the US Department for Agriculture (USDA) as a regional program to support improved forestry policy and management and livelihoods. It works through NGOs with communities to improve regional cooperation in forestry conservation and regeneration in Sierra Leone, Guinea, Cote d'Ivoire and Liberia.*

ANNEX C: ASSESSMENTS AND PROPOSED IMPLEMENTATION MODALITIES OF THE PROPOSED PROJECT

1. Implementation Mechanism – Developing Inclusive Improved Cookstoves Business

This project seeks to leverage private sector resources using market based mechanism and in partnership with relevant public sector agencies for ensuring that the efficient stoves being promoted and kilns to be demonstrated are fabricated, supplied and disseminated effectively as inclusive business where the poor and women could be empowered to participate as actors in the value chain. Therefore, there is a need to create demand for these aspirational appliances to reduce supply risk through commercially sustainable models, which include peer to peer training, institutional capacity development, knowledge and advocacy and, where applicable, financial support to promote this public-private partnership. The models will be continually improved during the Project implementation. Based on discussions with potential private sector participants initially identified, the models that could work for promoting market mechanisms are graphically shown in Figures 3 and 4 for stoves and kilns. The major elements of these models are described in the sections that follow.

Targets and prioritization

The target of disseminating 15,000 stoves (inclusive of 700 institutional and 300 industrial stove/furnaces) within the period of the project implementation will be achieved in four phases (Table 20). The first phase, will start at the later part of Year 1 and will prioritize districts that have strong presence of CBOs that have indicated strong interest to participate in the Project. This will increase the likelihood of success by building on the strong presence and networks of existing institutions that have on-going relationships with the villagers in the areas. Phases 2, 3 and 4 will be initiated by replicating the experience and success gained in Phase 1. In all 46 cookstove producers will be trained and certified.

Table 20: Scaling up programme of improved cookstoves in Sierra Leone								
REGION/DISTRICT	Number of Households	Average household size	Year 1	Year 2	Year 3	Year 4	Total	No. of Certified Cookstove Producers
i. Domestic cookstove			400	2,700	5,000	5,900	14,000	30
Kailahun	81,446	5.5	-	200	500	500	1,200	2
Kenema	112,027	5.6	-	190	300	200	690	2
Kono	54,676	5.7	-	110	200	200	510	1
EASTERN PROVINCE	248,149	5.6	-	500	1,000	900	2,400	5
Bombali	72,640	6.6	-	200	500	500	1,200	2
Kambia	45,489	7.3	-	50	100	150	300	1
Koinadugu	53,270	6.1	-	50	100	150	300	1
Port Loko	76,787	6.9	-	200	200	200	600	1
Tonkolili	62,617	6.6	-	50	100	200	350	1
NORTHERN PROVINCE	310,803	6.7	-	550	1,000	1,200	2,750	6
Bo	103,859	6.1	-	200	700	700	1,600	3
Bonthe	29,612	5.5	-	50	100	200	350	1
Moyamba	50,607	5.8	-	150	500	500	1,150	2
Pujehun	45,797	6.4	-	50	100	200	350	1
SOUTHERN PROVINCE	229,775	6	-	450	1,400	1,600	3,450	7

Western Rural	44,980	5.8	200	500	500	500	1,700	3
Western Urban	172,469	5.8	200	700	1,100	1,700	3,700	9
WESTERN AREA	217,449	5.8	400	1,200	1,600	2,200	5,400	12
SIERRA LEONE	1,006,176	6						
ii. Institutional stoves			8	42	244	406	700	10
Western Rural	44,980	5.8	-	14	14	60	88	2
Western Urban	172,469	5.8	8	20	80	150	258	5
WESTERN AREA	217,449	5.8	8	34	94	210	346	6
Bo	103,859	6.1		8	50	66	124	2
Bonthe	29,612	5.5					-	
Moyamba	50,607	5.8					-	
Kenema	112,027	5.6	-		50	70		1
Bombali	72,640	6.6	-		50	60		1
SOUTHERN PROVINCE	229,775	6	-	8	150	196	354	4
ii. Industrial stoves/furnaces			8	42	100	150	300	6
Western Rural	44,980	5.8	-	10	10	10	30	1
Western Urban	172,469	5.8	8	10	50	60	128	2
WESTERN AREA	217,449	5.8	8	20	60	70	158	3
Bo	103,859	6.1		10	20	40	70	1
Bonthe	29,612	5.5					-	
Moyamba	50,607	5.8					-	
Pujehun	45,797	6.4					-	
SOUTHERN PROVINCE	229,775	6	-	10	20	40	70	1
Kenema	112,027	5.6	-	7	10	20	37	1
EASTERN PROVINCE				7	10	20	37	1
Bombali	72,640	6.6	-	5	10	20	35	1
NOTHERN PROVINCE				5	10	20	35	1
Grand Total for Stoves			416	2,784	5,344	6,456	15,000	46

A small portion of stoves (i.e., 300 stoves out of 15,000 or 1.5% of the total number of stoves) will be allocated to the marginalized, disadvantaged households with single parent or disabled citizens that could not afford the stoves. For each district, the indicative target number of stoves to be disseminated was computed using the criteria based on population, intensity of fuel wood usage, forest cover, status of electrification, poverty index and existence of community forests and alternative energy focal person. The distribution has been designed so that at the end of Project the dissemination activities would have covered the whole country.

Use of local fabricators/technicians

The stove sector in Sierra Leone is still much undeveloped, with only a handful of stove producers currently operating on a market basis and producing stoves for sale:

- WonderStove by N'Jai at Murray Town, Freetown
- Culture stove by Macauley at Tengbeh Town, Freetown
- Bockarie Kargbo at Lunsar, Port Loko District
- Congo Town, Freetown

During PPG, a brief technical assessment into cooking stoves and manufacturers in Sierra Leone has been conducted. The purpose of the stove assessment was to provide a brief survey of existing stoves and the capacity of current stove producers in target areas, and to assess the viability of local

stove manufacture in Sierra Leone. However, a more detail technology assessment will be carried out during project implementation with the objectives to: (i) assess the quality and suitability of current fuel-efficient stove designs; (ii) assess the production capacity of existing stove producers and constraints to improved / expanded production; (iii) Assess the viability of local stove production in target areas where there are no existing stove producers; (iv) undertake an initial assessment of the viability of biomass pellets in Freetown; (v) provide recommendations for stove design and stove production / importing approaches.

Local improved cookstoves are manufactured by a web of metal workshops, dedicated manufacturers/assembler and retailers. The manufacturers can be disaggregated according to the following production models:

- Metal workshops that purchase clay molds but make other components and assemble themselves
- Dedicated stove makers working from home that make their own clay and either contract metal workshops or make their own casings.

Metal Workshops / Tin Smiths

These artisans already make traditional stoves and other products. They make metal cladding/frames/casings from scrap metal purchased from sheet metal dealers. They then purchase the clay liners from ceramicist mostly based around Waterloo. The ceramicists mine the clay from deposits very close to their villages. They have kilns where the molds are fired using firewood collected from nearby mangrove vegetation. They mostly produce the medium size stoves. There is no standard and certification on these processes.

Wonder Stove Enterprises

WonderStove is an early pioneer in introducing the improved cookstove to Sierra Leone from Kenya. Specialized production is carried out at three premises in Freetown. The raw materials for the production of the clay liners/moulds are purchased at a village close to Waterloo and transported to Wellington. The clay liners/moulds are produced at Wellington and transported to Murray Town. The metal frames are contracted out to tin smiths and then transported to Murray Town. The metal frames and clay liners are then assembled at Murray Town. The assembled stoves are then branded and ready for delivery to Retailers.

Assessment of In-Country Production Potential – Cook Stoves

The preliminary assessment included many meetings with local manufacturers including artisanal clay stove producers, metal workshops and cement casting factories. Overall, the manufacturing capacity for stoves in Sierra Leone is high. The “Jiko” stove adopted from Kenya has great potential for upscaling as they are light and robust for easy transport but the method of manufacturing needs to be refined and made more efficient. Further analysis and prototype development will be carried out during project implementation and the production potential for these stoves is considered high.

Considering the designs of the different stoves (i.e., cooking, institutional and industrial stoves), to be introduced and promoted in this Project, different types of fabricators/technicians are required. The cook stoves and institutional stoves will use mainly mud/clay as material with some metal components for cook stoves and minimal quantity of steel bars for cook stoves. The construction and installation of these stoves require skills normally possessed by an ordinary technician/mason. The cookstove technology landscape survey has done some preliminary identification of these skills in village levels in Sierra Leone. During the implementation of the Project, individual technicians will be identified in the targeted villages. The Project will conduct capacity building activities to train the technicians on the construction and installation of the stoves. Those who pass the training and agree to the modalities of the promotion and dissemination of these stoves will be accredited by the Project and will be registered as part of the pool of technicians in their respective villages. These certified producers will have access to start up loan as working capital for purchase of supplies as well as marketing and sale support (Figure 6).

The design of the cookstove to be promoted in the Project consists largely of metal parts to be procured and fabricated locally into a cooking stove. Some informal trainings are already taking place.

Some of the fabricators who were interviewed indicated their willingness to fabricate the stoves using the improved design. During the Project implementation, detailed negotiations on the modalities for the bulk production and dissemination of the heating stoves will be agreed with the interested fabricators/entrepreneurs.

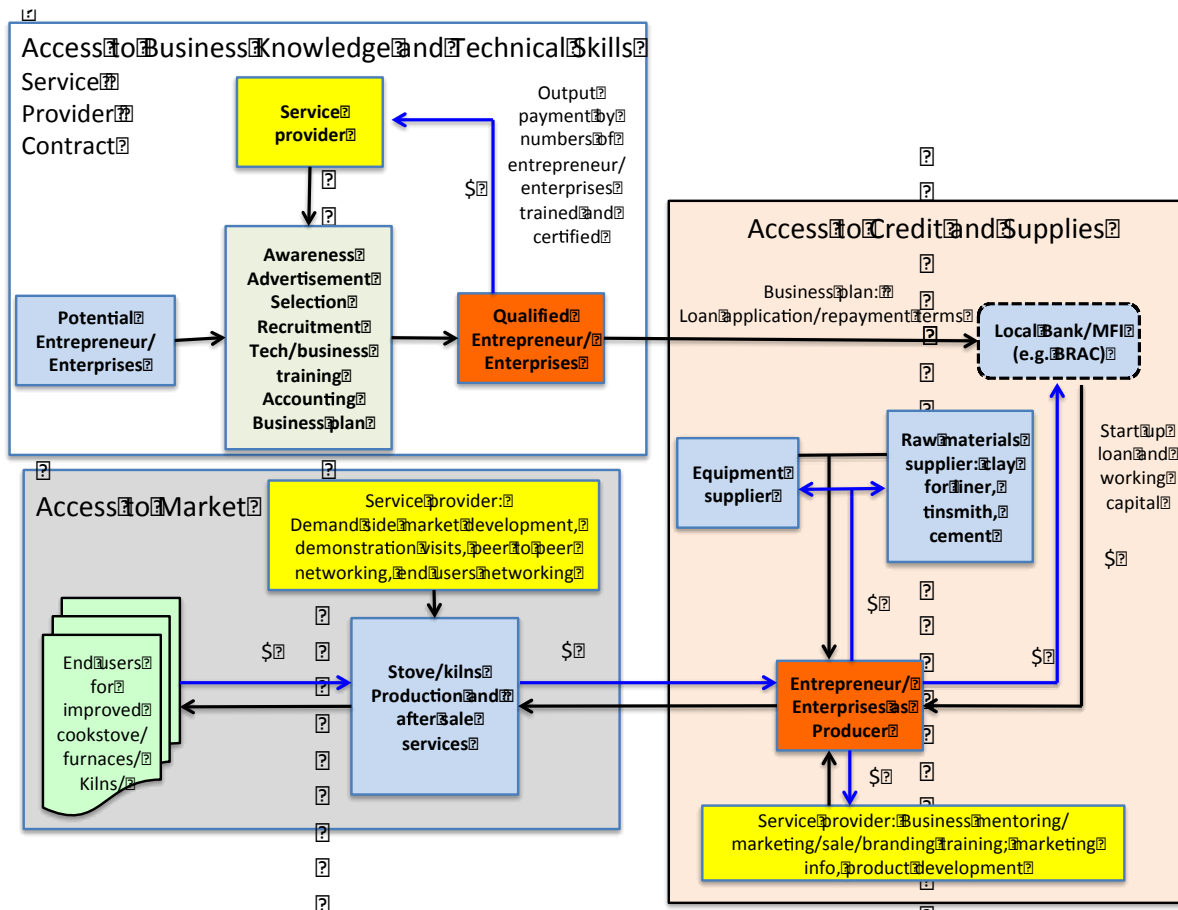


Figure 6: Business model for the up-scaling of improved cookstove and efficient charcoal kilns in Sierra Leone

Role of community-based organizations (CBO) and women in reducing demand and supply risks through a robust marketing and sale strategy

One major challenge in the promotion and dissemination of the energy efficient stoves as inclusive business is how to create a demand for the adoption of stoves by the potential end users to replace the existing traditional stoves currently being used in their households. There is a need to understand what are the potential cultural barriers (e.g. traditional use of smoke in rural life) that could hinder their uptake but rural populations have indicated willingness to switchover from their traditional to more modern stoves if the modern stoves meet certain criteria. Features that were mentioned were savings in fuel wood and improved health.

However, it is envisaged that in order to convince end users to replace their old stoves with the new design, a comprehensive marketing and sale strategy will be developed to raise awareness on the economic, health, social and environmental benefits of these stoves through:

- 1) High visibility mass media messaging: i) Point of sale marketing (branded pushcarts and displays in shops); ii) TV and radio adverts; iii) Posters / Billboards.
- 2) Person-to-person / word-of-mouth messaging: i) Door-to-door sales using branded pushcarts; ii) Awareness-raising and education outreach by government and civil society (Women and Mothers Union); iii) Roadshow and Demonstration events (rural and urban)

The high visibility mass messaging is crucial for raising the profile of cookstoves, and making them highly recognisable around the country. The more personal messaging (person-to-person) is crucial for generating awareness and triggering purchasing decisions.

A system should also be set up for end users to have a standard mechanism to place orders, make payments according to a cost sharing mechanism, a system of registering complaints and making contribution in upgrading and improving the design of the stove or requirement for after-sales service, while being assured that the stove are constructed, certified and labeled to international standard (Figure 7).

For these aspects, the Project will work with community-based organizations (CBOs) and grassroots and women institutions that are already actively present and have complimentary climate mitigation and adaptation activities in the rural areas. Likewise the Centre of Excellence will be set up to champion the good causes of clean technology. In this document, CBOs refer to both the registered and non-registered non-profit organizations. During the project preparation stage, CBOs already existing such as youth groups and women's groups have been identified (see list in Table 11) to fit into this category and have given indications that they would be willing and interested to provide this role within the Project.

Special focus will be placed to ensure that women are empowered to participate in the project design and implementation; create energy policy and strategy that are gender sensitive, provide peer to peer technical and business training for women, access to market and business opportunity.

Working as the local coordinator in the village level, the CBOs will perform the following roles (Figure 7):

- Conduct awareness campaign among the villagers on the benefits and importance of the promoted stoves that have been certified by CCDC
- Market the promoted stoves for maximum uptake from the village
- Conduct training of household members on proper operation and use of the stoves
- Receive individual orders of stoves from households
- Place bulk order of certified stoves with the fabricator for thermal heating stoves or the technician(s) for the cookstoves
- Only certified stoves with label could be produced by certified producers and eligible for end user rebate and loan guarantee scheme (Figure 7)
- Receive payment of the cost sharing portion from individual households
- Deliver payment to the fabricator/technician for the installed certified stoves
- Issue delivery certificate countersigned by the individual customer and CBO authorized representative to the fabricator/technician
- Ensure that the quality of the work of the fabricator(s)/technician(s) serving its village/district is consistently acceptable and recommends re-training or additional training, if necessary.

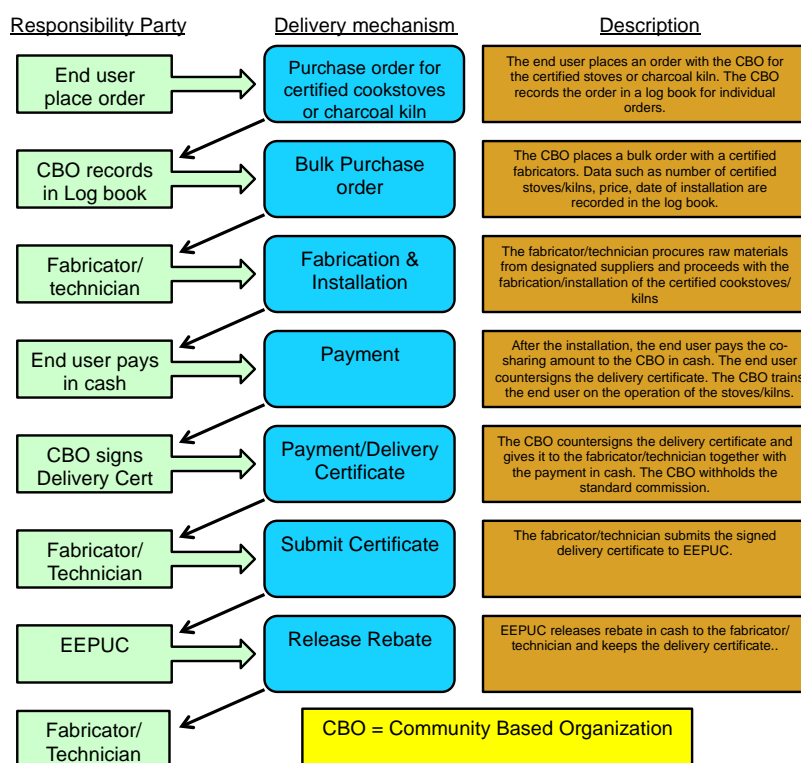


Figure 7: Rebate Delivery Scheme for Certified Improved Stoves and Charcoal Kilns

Table 21: Major relevant public, private and community-based organizations stakeholders in Sierra Leone		
Category	Example Entities	Activities
Government Ministries	<ul style="list-style-type: none"> Ministry of Energy - MOE Ministry of Land, Country Planning and Environment Ministry of Agriculture, Forestry and Food Security Forestry Division Ministry of Local Government and Rural Development 	<p>Set national agenda, fund programs, provide support for NGO's, capacity building, conduct awareness activities</p> <p>Conduct business training programme for youth and women</p>
Foreign Government Agencies	<ul style="list-style-type: none"> EU DFID USAID 	Fund programs, provide technical and logistical support
Multilateral Organizations	<ul style="list-style-type: none"> UNDP UNIDO ICRAF WFP 	Fund programs and build capacity
International NGO's	<ul style="list-style-type: none"> Energy for Opportunity, World Vision, Oxfam, CARE, Concerns International 	Fund and run programs, provide technical and logistical support, engage and partner with organizations at local level, conduct awareness activities, capacity building
National Organizations and NGOs	<ul style="list-style-type: none"> Renewable Energy Center, NJala University EFO EFA 	Promote clean cookstoves, biogas, run programs, solar, engage communities
Suppliers	<ul style="list-style-type: none"> Toyola Energy WestWind Energy SAMU Enterprise Bockarie Enterprise 	<p>Produce clay coosktoves, tin smiths</p> <p>Produce Kenyan cookstoves</p>

The above roles and responsibilities, which cannot be effectively performed by the EEPUC Project in Freetown, are pivotal for the successful promotion and dissemination of the stoves. Hence, for the duration of the Project, the full operating costs of the CBOs to perform the abovementioned activities will be borne by the Project. However, it is envisaged that at the end of the Project, CBOs will cover their operational costs by charging a standard minimal fee as a percentage of the price of the stoves. This transition to market mechanism where the CBOs are rewarded as a function of the volume of the sales of the product (as an output based approach) will continue to provide incentives for them to aim for success. The fee to CBOs will be built into the overall price of the stove. Although this could slightly increase the cost of the stove, the participation of the CBOs will:

- help to create local demand so that supply, producer and delivery risks could be minimized to generate market confidence
- reduce inefficiencies in the transaction between the end user and the fabricator/technician
- free up some time of the fabricator/technician for the production of more stoves instead of doing the marketing of their product and training the end users
- put the task of the awareness campaign and marketing to an entity that has a local presence and has the motivation to deliver the required volume of stoves (e.g. Women group)
- transform the stoves into a aspirational goods that has a standard quality, label, price and services

Such benefits could translate into savings of time and money for those involved in the installation and dissemination of the stoves that would be of more value than the additional fee to the CBO.

Inclusive value chain financing

The GoSL and UNDP Sierra Leone are collaborating to explore innovative ways to mobilize the private sector to contribute proactively to development – this will be done by setting up social businesses and through partnership agreements, providing them with much needed business development services. Social business networks of relevant stakeholders will also be setup for horizontal/vertical linkages and mutual support. The objective of this project is to promote high impact social enterprises that will contribute to private sector development as well as attainment of MDGs. As a result of this Project, social enterprises will contribute to the reduction of poverty in rural areas and generate rural employment and income. Investing in products and services, through both microenterprises and cooperatives that meet the needs of local communities will build local market demand, which will, in turn, drive local production, and with the multiplier effect will impact not only income levels but also the overall well being of communities.

Business Mentoring and incubation

This GEF funded project will partner with UNDP Business Development Services and Ministry of Social Affairs and Ministry of Industry and Commerce to improve the business knowledge and technical skills of budding social entrepreneurs. The Project will compile training modules like Costing, Record Keeping, Stock Control, Buying and Financial Planning and Marketing adapted to the needs of alternative energy businesses. For example, in partnership with Toyola Energy or WonderStove, businesses will be identified for upgrading and expansion of these identified businesses to become rural and peri-urban Alternative Energy Centres that will supply alternative energy technology and provide regular servicing and maintenance of the products. While Toyola Energy and WonderStove focuses on the technical aspect of the products, the UNDP Business Development Services could focus on business management and customer service. It is expected that these businesses will demonstrate the profitability of offering such technology in rural and peri-urban markets, and encourage Freetown-based suppliers to replicate this model and extend their sales network to other energy poor areas.

Cost sharing and start up rebates

The current prices that the households are paying for their traditional stoves are shown in Table 22 below. In comparison, the estimated prices of promoted stoves are substantially higher. This is so because the improved cook stoves promoted in this Project will require improved quality and better materials.

It must also be noted that because of the above features of the improved cook stoves promoted in this Project, the costs of manufacturing them are higher than the prices of cook stoves being disseminated by other programmes in other countries. Hence, the Baseline Survey and investigations conducted during the PPG stage revealed that it is necessary to provide some form of rebate to cover for the incremental cost of purchasing the new systems for domestic, institutional and industrial cookstove.

As explained above, in assessing poverty indicators such as income, the market report shows that 43% of the total households live below the poverty line. Often the poverty is linked to lack of access to land holdings, micro credit or loans and rely on subsistence farming for daily survival that often face food shortages in the dry season. Furthermore, lack of collateral and inability to repay are the reasons for not taking up loans. It therefore is apparent that not all have the capacity to take up loans. Therefore, promoting improved cook stoves in the country without rebate will risk exclusion of many who will continue to use inefficient stoves and large volumes of fuel wood. Balanced socio-economic development and reduction in emissions from stoves will not be easily achieved.

Table 22: Indicative cost of stoves/kilns				
	Domestic cookstove	Institutional Stoves	Industrial Stoves	Charcoal kilns
Current cost of stove/Kiln (average), USD	7	35	100	200
Total cost of new stove/Kiln (estimated), USD	12	300	700	2,000
Cost of current stove/Kiln as a percentage of total cost of new stove	58%	12%	14%	10%

From the EFO (2012) market study, the respondents indicated that they desire to experience from improved stoves attributes such as durability, less smoke emissions, better heat and duality of use (cooking) and less fuel wood use. The end-users are willing to pay for this difference because of the benefits that they will receive for using the new stoves, such as cleaner indoor air, reduction of health hazards and reduction of fuel costs due to decreased wood fuel consumption.

Using the principle of “start up rebates”, the fiscal support that will be provided to the end users will be reduced as the volume of the uptake of the stoves increases. This gives incentives for the potential end users to make an early decision and “try” the new system. The early batches of users are needed to create a demonstration effect and all other potential end users to observe the benefits of the promoted technologies. As the benefits are experienced by the early users and seen by the neighbors and other potential users, the true value of the system are no longer perceived but becomes known and hopefully appreciated. This will help to create a tipping point towards market transformation for clean and affordable solutions. The process of making the rebate payable once the quality has been checked and approved works as a powerful mechanism to ensure quality control.

It is proposed that a rebate of 70% of the full cost of the cook stoves will be given to users who belong to the first 40% of the targeted number of stoves to be disseminated. This rebate will be reduced to 60% for users who belong to the next 50% of the target group, and finally, to 40% for users who belong to the last 20% of the target group. An indicative smart rebate scheme is presented in Table 23.

At the end of the Project, it is expected that the energy efficient stoves will be sufficiently demonstrated to allow market mechanism to prevail without or with minimal rebate. It is also hoped that at the end of the Project the procedures for the construction of stoves will be more streamlined, and combined with better economy of scale, the price of stoves would be reduced, making it more affordable for end-users to purchase even without the benefit of rebates. The Project will explore if revenues from carbon credits could be realized and the benefits from this revenue stream will be used to further enhance the market mechanism through support to be provided to local entrepreneurs or financing institutions. During the Project implementation, UNDP will contribute and work with DNA to assess the potential for generating carbon credits for voluntary market on future replication activities and initiate documentation for their compliance.

Year	1	2	3	4
Percentage uptake of targeted volume in each Phase of roll-out	>0-60%	>40-60	>60-80%	>80-100%
Rebate as a percentage of the cost of the stove	60%	50%	40%	30%
Amount of rebate for domestic cookstoves, USD	7.2	6	4.8	3.6
Amount of rebate for institutional stoves, USD	180	150	120	90
Amount of rebate for industrial stoves, USD	420	350	280	210
Amount of rebate for charcoal kilns, USD	1,200	1,000	800	600

In order to have equity and ownership among the users of stoves and to have a fair treatment for all districts in the different phases of the roll-out of these stoves, the principle of introducing higher rebate at the beginning and phasing it out as the uptake increases will be applied similarly in each of the four phases of the stoves dissemination. Using the distribution plan in Table 24 as the basis for calculating the rebates at each year of the project implementation, the resulting amount of rebates according to year and type of stove is given in Table 25.

Description	Domestic Cook Stoves	Institutional Stoves	Industrial Stoves	Total Stoves	Charcoal Kilns
Phase 1 Districts	1,000	20	20	1,040	50
Year 1 (40%)	400	8	8	416	20
Year 2 (60%)	600	12	12	624	30
Year 3 (0%)	-	-	-	-	-
Year 4 (0%)					
Phase 2 Districts	3,500	50	50	3,600	200
Year 1 (0%)	-	-	-	-	-
Year 2 (60%)	2,100	30	30	2,160	120
Year 3 (40%)	1400	20	20	1,440	80
Year 4 (20%)					
Phase 3 Districts	4,500	280	100	4,880	300
Year 1 (0%)	-	-	-	-	-
Year 2 (0%)	-	-	-	-	-
Year 3 (80%)	3,600	224	80	3,904	240
Year 4 (20%)	900	56	20	976	60
Phase 4 Districts	5,000	350	130	5,480	450
Year 1 (0%)	-	-	-	-	-
Year 2 (0%)	-	-	-	-	-
Year 3 (0%)	-	-	-	-	-
Year 4 (100%)	5,000	350	130	5,480	450
Total	14,000	700	300	15,000	1,000

Table 25: Amount of rebate according to year and type of stoves and kilns					
Description	Domestic Cook Stoves	Institutional Stoves	Industrial Stoves	Total Stoves/ Cost	Charcoal Kilns
Year 1					
No. of stoves/kilns	400	8	8	416	20
Full cost of stoves/kilns	4,800	2,400	5,600	12,800	40,000
Amount of rebate	2,880	1,440	3,360	7,680	24,000
Amount of cost-share	1,920	960	2,240	5,120	16,000
Year 2					
No. of stoves/kilns	2,700	42	42	2,784	150
Full cost of stoves/kilns	32,400	12,600	29,400	74,400	300,000
Amount of rebate	16,200	6,300	14,700	37,200	150,000
Amount of cost-share	16,200	6,300	14,700	37,200	150,000
Year 3					
No. of stoves/kilns	5,000	244	100	5,344	320
Full cost of stoves/kilns	60,000	73,200	70,000	203,200	640,000
Amount of rebate	24,000	29,280	28,000	81,280	256,000
Amount of cost-share	36,000	43,920	42,000	121,920	384,000
Year 4					
No. of stoves/kilns	5,900	406	150	6,456	510
Full cost of stoves/kilns	70,800	121,800	105,000	297,600	1,020,000
Amount of rebate	21,240	36,540	31,500	89,280	306,000
Amount of cost-share	49,560	85,260	73,500	208,320	714,000
Total number of stoves/kilns	14,000	700	300	15,000	1,000
Total cost of stoves/kilns	168,000	210,000	210,000	588,000	2,000,000
Total rebate	64,320	73,560	77,560	215,440	736,000
Total cost-share	103,680	136,440	132,440	372,560	1,264,000

Indicative modalities and procedures for distribution of stoves

During the early part of the Project implementation, the activities related to the promotion of output based and market mechanisms will focus on the identification of fabricators/technicians and the CBOs in the different targeted villages and districts. Although the principles of the modalities have been discussed with some potential CBOs, the detailed modalities and procedures will be agreed with these entities during the Project implementation. These modalities and procedures will include aspects such as:

- Procedures for procurement of raw materials
- Pricing of stoves
- Payment mechanisms
- Amount and mechanics of rebate
- Roles and responsibilities of different parties
- Quality control and assurance
- Content of the training programme

An indicative procedure for the distribution of stoves based on supply and demand contract and description of the different steps for the delivery mechanism is graphically presented in Figure 8.

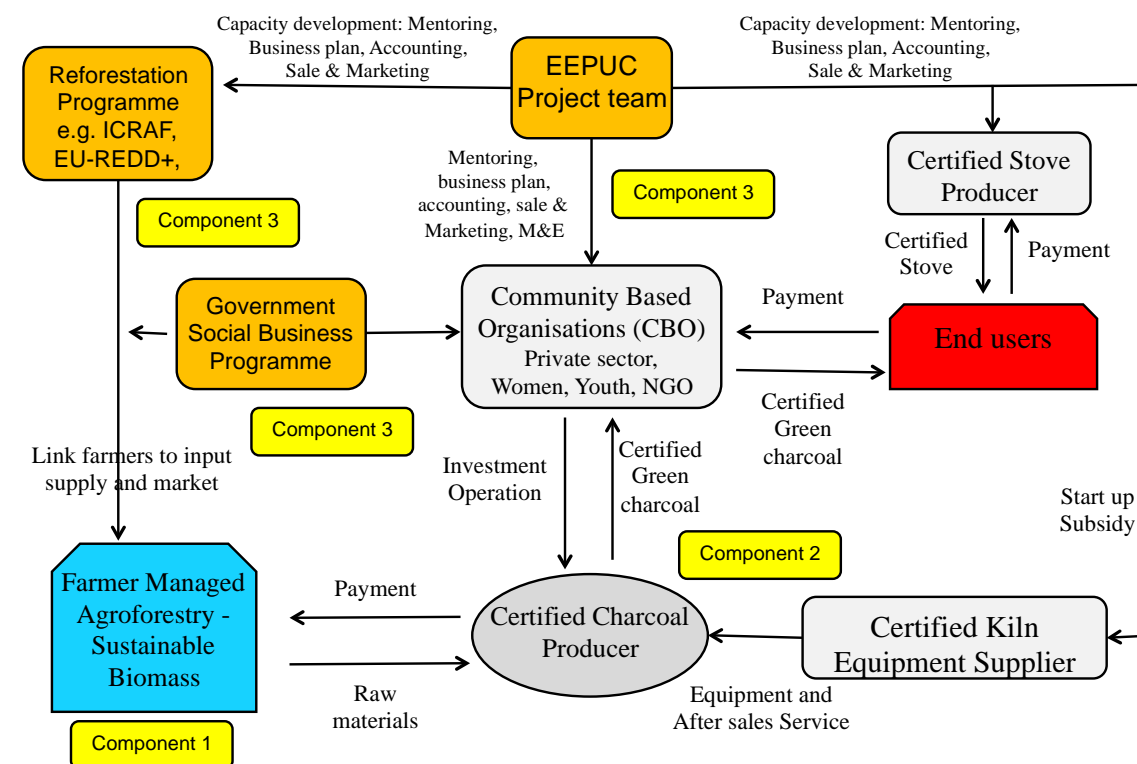


Figure 8: Market based approach and value chain financing for the scaling up of stoves and kilns

2. Implementation Mechanism – Developing Sustainable Charcoal Business

The overarching objective of developing sustainable certified charcoal business is to balance the demand for wood for charcoal production with the quantity of wood that can be sustainably harvested for that purpose. In most countries, the demand for wood exceeds the amount of wood that can be sustainably harvested. As a consequence, the collection of wood for charcoal production is often a key driver of deforestation.

To demonstrate the use of the efficient kilns for sustainable and certified charcoal production, the EEPUC Project will scale up 1,000 units of efficient kilns in selected sites (Table 26). During the implementation stage, a detailed feasibility study will be conducted in collaboration with Forestry Division in partnership with the ICRAF and EU-REDD+ programme to finalize the selection of producers and site conditions, determine the detailed specifications of the retort kiln technology, business model and incentive schemes and study the detailed economic and financial performance of the demonstration project (Output 2.4). The kiln installation, training programme and business model will be procured through a national tender process (Figure 5). The kiln owner will contribute a portion of the cost of the system through a cost sharing mechanism, while the EEPUC Project will provide start up grant to cover a portion of the equipment cost based on the standard and certification scheme (Table 23, 24 and 25). Overall 100 retort kiln producers will be trained and certified.

REGION/DISTRICT	Number of Households	Average household size	Year 1	Year 2	Year 3	Year 4	Total	No. of Certified Charcoal Producers
iv. Charcoal Kilns			20	150	320	510	1,000	100
Kailahun	81,446	5.5	10	10	30	50	100	10
Kenema	112,027	5.6	10	20	30	30	90	9

Kono	54,676	5.7	0		20	20	40	4
EASTERN PROVINCE	248,149	5.6	20	30	80	100	230	23
Bombali	72,640	6.6	0	20	40	50	110	10
Kambia	45,489	7.3	0	20	40	60	120	14
Koinadugu	53,270	6.1	0	20	20	30	70	7
Port Loko	76,787	6.9	0	20	40	60	120	14
Tonkolili	62,617	6.6	0		10	25	35	3
NORTHERN PROVINCE	310,803	6.7	0	80	150	225	455	48
Bo	103,859	6.1	0	20	30	60	110	12
Bonthe	29,612	5.5	0	0	10	30	40	4
Moyamba	50,607	5.8	0	15	20	40	75	7
Pujehun	45,797	6.4	0	0	20	30	50	5
SOUTHERN PROVINCE	229,775	6	0	35	80	160	275	28
Western Rural	44,980	5.8	0	5	10	25	40	4
Western Urban	172,469	5.8	0					
WESTERN AREA	217,449	5.8	0	5	10	25	40	1

Basis for developing a sustainable charcoal business

From a review of relevant charcoal production literature and based on many West African experiences, it is evident that charcoal production methods cannot be evaluated just on the basis of technical factors only, social factors and cultural factors are of equal importance. For successful diffusion and adoption of energy technologies as inclusive business, proper identification of the combination of technology and the target group is a major determining factor. Matching innovation attributes with the characteristics of the potential adopters is critical for diffusion and adoption of innovations. The following considers the criteria for the selection of kiln designs.

i. Socio-Economic Factors

In communities where social factors are dominant, it is usually very difficult to introduce a new technology of charcoal-making unless the social factors have been addressed. The practice where there are attempts to modify the technology of charcoal-making by providing inputs such as chain saws, new kilns and any other inputs has resulted in disappointments when these inputs stop flowing. In addition, burning of charcoal requires skill, patience, experience and readiness to observe correct working methods at all times. The economics of the operation is determined by the yield achieved in the burning stage. In a situation where capacity to use the new and efficient technologies is not well developed and the necessary inputs lacking, economic necessity will force the producers to revert to the traditional but predictable and well understood methods with all their obvious technical faults. The technologies selected therefore took into consideration the following factors:

Appropriateness to the Target Users: Appropriateness will address issues of user friendliness and safety during operation. If the operation of the technology is not well understood, it will lead to high losses and health and safety issues. As mentioned earlier, the economics of the charcoal enterprise depends to a great extent on the charcoal yields during the carbonization process. Safety will address issues of not only protection from injury, but also protection from pollution. Carbonization being a process that takes place in circumstances of limited oxygen and inevitably results in substantial diversion of biomass carbon into products of incomplete combustion (PIC), which include carbon monoxide (CO) that is poisonous to human beings. Most important is the need to identify the crucial players for sustainable charcoal production. Most of the producers in Sierra Leon are small producers with low women participation. It is important that the technology chosen is easy for women to operate.

Affordability: When determining affordability of the technologies, both the cost of the hardware (conversion technology, the kiln/retort) and the cost of operations were considered. Operations include: Cost of felling trees, transporting billets, billet preparation, loading and or stacking the kiln/retort, operating retort during carbonization and unloading/harvesting the charcoal. The other important cost is the time taken for the entire operations, although it can be argued that rural people have more time than money and could therefore afford to be patient for several weeks. Most of the

producers interviewed do not have collateral but have expressed willingness to contribute in kind (labour, materials) and would be willing to take up affordable loans with favourable interest and repayment periods.

Gender sensitivity: Women in most Sub-Saharan African countries participate in village woodlots or take care of home gardens that supply the much needed fuel wood. Women, therefore, play a significant role in the production of fuel wood. They have knowledge on the art of making charcoal and can identify what the properties of materials suitable for fuel wood are and they even gather woods both for commercial and domestic purposes (Texon, 1998). Gender considerations in the choice of a charcoal production system and or technology is important because fuel wood gathering for domestic and commercial purposes requires the utilization of human energy, in which, women contribute the larger part. In Sierra Leone, agriculture is the main occupation of women. Nationwide, agriculture employs 80% of all employed women and 90% of all rural women work in agriculture. Hence, in the event of deforestation, it would become more difficult for rural women to gather firewood. Women are more likely to appreciate issues of sustainability compared to men.

Compatibility with norms and beliefs: The choice of an appropriate charcoal conversion technology must contend with the challenges of providing a consistent and reliable technology that will generate more income and benefits in comparison with the traditional sources of income and survival. To cause sustainable change in the charcoal production system, it is imperative to introduce a production system that is compatible with values and expectations of the target communities. Given that for sustainability, the wood should be grown, or selective cutting of coppices from properly managed forests, the conversion technology should be able to efficiently convert wood of small diameter. Fortunately, for planted trees, the age determines the diameter. This is true of the coppices. The slow-growing trees respond well to coppicing, lopping and pollarding. Where tree planting is taking place and where forest management or selective harvesting is taking place, the required diameter can be achieved.

ii. Technical factors

Wood Species and Size of Billets: According to FAO, (1987), the carbonization rate is closely related to wood size. Large wood pieces carbonize slowly since the transfer of heat into the interior of the wood is a relatively slow process. On the other hand, large diameter trunks of dense species may either shatter when carbonized and thus making the charcoal more friable than otherwise or fail to carbonize completely leading to loss of wood and time.

Efficient carbonization of large diameter trunks and mixed size charges is best using the slower cycle, larger masonry kilns. The cost of cutting up wood is a serious and growing one as fuel, labor and capital costs increase and this favours the use of earth pits, mounds and brick kilns. It is also usually easier and faster to charge kilns with large size wood, especially if its length conforms to the size of the kiln, pit or mound. It is worthwhile carefully studying the relation between growing, harvesting, drying and kiln charging to decide the optimum dimensions of the wood both in length and diameter, so that overall handling and carbonizing costs are minimized and charcoal of optimum properties for the final end use is obtained.

Climatic and Soil Conditions: Charcoal production is often a seasonal activity. Dry season can lead to: hardening of the soil and making it difficult to make mounds; have to fetch water and pour it on the ground to soften the soil before covering the kiln; make it harder work for women; increases in charcoal prices with implication for the poor. Rainy season production are characterized by: competition for labour from agricultural activities; keeping the covering of the timber charge intact; pit kilns require channeling of surface water from the pit; winds are also an important factor especially for the earth mound kilns and the use of windshields or strategic positioning of the kiln is often a requirement with some methods. An all-weather technology whose efficiency is not affected by weather conditions is the solution to these challenges.

iii. Carbonization technology

The most common method of carbonization is the kiln method which employs direct burning of part of the charge to provide the necessary heat required for carbonization to take place. The problem with this method of carbonization is that part of the wood that would have been converted to useful charcoal, is actually burnt. The other problem is that when the carbonization process starts, it is very difficult to control in terms of temperature regulation and carbonization speed. There have been

several efforts to improve kiln technology and especially for the small scale charcoal producers. One of the improvements is the Tones Kiln.

Tones kiln: The Tones kiln was developed in Senegal and is an earth mound kiln equipped with a chimney. This chimney, which can be made out of oil drums, allows a better control of air flow. In addition, the hot flues do not escape completely but are partly redirected into the chimney of the kiln, which enhances pyrolysis. Due to this reverse draft, carbonization is faster and is more uniform than the traditional earth mound kilns giving a higher quality of charcoal and efficiency which ranges between 18 and 25% according to the level of expertise by the operators. Comparative tests of the Tones kiln and traditional mound kilns confirmed the advantages in terms of efficiency and the shorter carbonization times due to the enhanced hot flue circulation (Meule casamancaise PERACOD Mundhenk, 2010). The other advantage is its ability to carbonize billets with large diameters. The major disadvantage of this kiln type is that the PIC which include CO, CH₄, and HC cannot be condensed at those temperatures and inevitably escape to the atmosphere. The other disadvantages are that it requires some capital investment for the chimney and it is more difficult to construct compared to the traditional earth mound kilns.

The Adam Retort: The Adam Retort is one of the most efficient means of producing good quality charcoal. During carbonization, the wood gases, volatiles (PIC) and all the tar components from the retort are channeled to the external fire box and are burnt to provide the needed heat for the carbonization process. The Adam Retort also called the Improved Charcoal Production System (ICPS), is being piloted as one of the technologies. Efficiency can be as high as 40% and noxious emission can be reduced by 70%. In addition, the production cycle is completed within 24 to 30 hours depending on the size. The retort is suitable for semi-industrial production.

Disadvantages the rather high investment costs that could be nearly US\$2,000 depending on location and special skills are required for construction. However, if several retorts are to be constructed in the same location, the technology could benefit from the economics of scale and the cost could reduce tremendously. The other disadvantage is that the retort may not handle mixed species and widely varied sizes of billets adequately. This calls for high investments in wood preparation. The Adam retort is being promoted in several countries including Senegal, Madagascar, Peru, etc. on a pilot basis. Currently, the method is being further refined for up-scaling. However, the design is patented and permission will be required from the patent owner and license fees will need to be paid. This will be covered as part of the installation cost.

The Sam1 Brick Retort: The Sam1 Brick Retort operates much in the same way as the Adam Retort. The major difference is that the fire box is within the retort as opposed to the external fire box. The heat losses to the walls of the fire box are minimized. The result is that it takes a shorter time and less fire wood to be fired. However, because the fire box is directly under the retort, the retort is slightly higher than the Adam Retort for the same capacity. But the retorts take the same quantities of cement, sand and bricks with no license fees.

The need for piloting the selected designs and business model

Currently, the majority of charcoal producers get their wood fuels from natural forests. Wood from the natural forests is often a mixture of sizes and species. Mixed species and varied diameter sizes cannot be handled well by the selected retort designs. Large billets require transport and labor to handle. They are best carbonized at the site of harvesting. The Tones kiln therefore will be appropriate in such circumstances. However, as forest management takes root and selective harvesting and the use of coppices and sprouts increases under the ICRAF and EU-REDD+ projects, smaller diameters (which give better charcoal and can be easily carried by the women) will become available. Then the more efficient conversion technology, which at the same time is more environmentally friendlier, will be preferred by the enterprises.

For the households that are already planting trees that can be converted into charcoal, the retorts make more sense to the enterprises because of the high conversion efficiencies, convenience, reduced costs of operations and safety. For those with access to natural forests, the application of the technologies could be sequenced; beginning with the Tones and then either the Adam Retort or the Sam1 Brick retort. If the household has access to all types of wood, then all the conversion technologies could be applied.

Access to Credit

Provision of bank credit is not common in rural areas, however there are some Micro Finance Institutions being established and are in operation in limited places. Investment in charcoal production can generate cash returns through selling the products. Therefore potentially charcoal producers have the potential cash for repayment if loans are available. But the low level of timely repayment for such credits could be a deterrent for MFIs to lend to small businesses. However, BRAC has expressed interest to assess the feasibility to lend to charcoal producers through their small enterprise loan (USD 2,000 to 6,000) under their equity and UNCDF portfolios if the GEF funded project could provide partial loan guarantee and Technical Assistance to help producers to develop a sound business plan for loan application.

Using Quasi Experimental Design to Formulate Cost Efficient Start Up Grant: Using the same “startup grant” principles that apply to cookstoves, the fiscal support that will be provided to the producers will be reduced as the volume of the uptake of the kiln increases. This gives incentives for the early adopters to “try” the new system. The early batches of users are needed to create a demonstration effect and all other potential producers to observe the benefits of the promoted technologies. As the benefits are experienced by the early adopters and seen by the neighbors and other potential users, the true value of the system are no longer perceived but becomes known and hopefully appreciated. This will help to create a tipping point towards market transformation for clean and competitive kiln.

As recommended by GEF-SEC, instead of providing a blanket start up grant to all producers, two types of start up grant will be tried based on income status and affordability of the producers to be replicated across the 4 districts:

i. For lower income group (USD 5,000 per year): It is proposed that a rebate of 70% of the full cost of the kiln will be given to early adopters who belong to the first 40% of the targeted number of kilns to be disseminated. This rebate will be reduced to 60% for producers who belong to the next 50% of the target group, and finally, to 40% for producers who belong to the last 20% of the target group. An indicative start up rebate scheme is presented in Table 17.

ii. For higher income group (Above USD 5,000 per year): It is proposed that a rebate of 50% of the full cost of the kiln will be given to early adopters who belong to the first 40% of the targeted number of kilns to be disseminated. This rebate will be reduced to 30% for producers who belong to the next 50% of the target group, and finally, to 10% for producers who belong to the last 20% of the target group.

At the end of the Project, it is expected that the new kiln will be sufficiently demonstrated to allow market mechanism to prevail without or with minimal rebate. It is also hoped that at the end of the Project the procedures for the construction of certified kiln will be more streamlined, and combined with better economy of scale, the price of certified kilns would be reduced, making it more affordable for producers to purchase even without the benefit of rebates or loan guarantee scheme.

The Project will also explore if revenues from carbon credits (from NAMA or Green Climate Fund) could be realized and the benefits from this revenue stream will be used to further enhance the market mechanism through support to be provided to local entrepreneurs or financing institutions. Accessing climate fund will be developed as a potential for the phasing out of inefficient and obsolete technology (Output 2.6).

The implementation mechanism model for efficient kiln scale up is shown earlier in Figure 8 above.

3. Proposal of Mobilization of the Loan Guarantee Funding Scheme (LGFS) Mechanism

i. Rationale: In addition to the rebate scheme, the mobilization of the Loan Guarantee Funding Scheme will be proposed to be included in the EEPUC project as a pilot to remove the financial barriers for the following reasons:

- Lack of collateral to access competitive loans and credits. In fact, the key financial barrier identified during PPG has been the limited asset collateral available for most SMEs, due to lack of land ownership and land title.
- There is limited experience in loan guarantee funds in Sierra Leone that could successfully assist SMEs in accessing commercial loans. MFI like BRAC has some experience in the dealing with LGFS. The GEF assistance for the development of the Loan Guarantee Fund to be managed by local bank will unblock funding sources for improved stove and charcoal supply investment. Financial support from the GEF will be used to guarantee to both Stove and Charcoal Service Providers (SPs) and SMEs in implementing the EEPUC project. All information on establishment of Loan Guarantee Fund Mechanism under the EEPUC project is as following:

ii. Objective: To set up a loan guarantee fund scheme mechanism that will support the commercial funding of improved certified cookstove and certified charcoal kiln value chain business to be undertaken by Stove and Kiln SPs and SMEs.

iii. Loan Guarantee Fund Size: At the demo stage, capital support from GEF of US\$ 250,000 will be used to set up a loan guarantee fund for Stove and Kiln value chain investment projects.

iv. Recipients: All SMEs having Stove and Charcoal Kiln investment proposals are eligible to enjoy such financial support program. However, due to limited capital, at the early stage, the program will focus on domestic and institutional stoves, charcoal kiln as well as sectors that need renovate technology/equipment to save energy, such as bread making, salt production, brick, ceramic, food processing cottage industries. The Fund will guarantee selected certified SMEs (the end-user) who have been trained and have insufficient collateral to get commercial bank loan for implementing stove and charcoal project. The program also provides guarantee for Stove and Kiln Service Providers (SPs) (third party financing) and in turn these companies will provide stove/furnace/kilns technical services to SMEs. SMEs pay fee to Stove and Kiln SPs for using technical services rather than borrowing bank capital for stove and kiln investment.

v. Participating Parties involved in LGFS' Operational Mechanism:

(1) LGFS managing Bank: the guarantee fund of US\$ 250,000 will be deposited in trust in the local bank. The money will deposit in stages as the guarantee portfolio increase. The local bank will also act as the fund manager as designated by the Ministry of Finance.

(2) Participating credit institutions: these institutions (e.g. BRAC) will provide lending to SMEs in implementing stove and kiln production activities under the guarantee from the LGFS managing bank. Any commercial bank that has experiences in lending to SMEs and handling lending from international support could be a participating bank.

(3) The Project Management Unit: the PMU of the EEPUC Project will conduct technical assistances to involved parties in operating the LGFS. The office will also advise the Stove and Kiln Project Appraisal Committee in selecting projects and supervise the LGFS's activities according to its regulations.

(4) Renewable Energy Center, CCDC and Ministry of Energy in participating provinces/cities: these agencies will act as local focal points to receive SME's applications on loan guarantee for their Stove and Kiln investment projects and facilitate the meetings of the Stove and Kiln Project Appraisal Committee.

(5) The Stove and Kiln Project Appraisal Committee: The Committee will consist of representatives from MOE (PMU), UNDP and local bank. The Committee has the following tasks and powers: (i) to adopt the strategy operation, financial plan and final account settlement reports of the Fund; (ii) to select the Stove and Kiln investment projects that will be guaranteed by the LGFS and submit the list of selected projects for NPD's approval. Senior advisors on Stove and Kiln activities should be invited to be a participant in the Committee meeting of selecting the loan guarantee projects on case-by-case base.

vi. Guarantee level: the Loan Guarantee Fund will only provide a partial guarantee for the portion of the loans not covered by collateral. The maximum ceiling of guarantee will be discussed in details between local bank and the Project Management Unit. Based on the existing guarantee policy in Sierra Leone, this will not exceed 75% of the portion of total loan.

vii. Procedures of guarantee: the guarantee procedures are summarized in Figure 9.

viii. Conditions to operate the guarantee system: to implement the above mentioned guarantee system, the following conditions need to be addressed:

- Sources to cover management fee of the LGFS managing bank and the meetings of the Stove and Kiln Project Appraisal Committee.
- SMEs as the guarantee beneficiaries must pay guarantee fee.
- Local bank must pay interest for deposited money in the LGFS at the Bank (Interest Rate for the Fund at the Bank is equal to the interest rate of the non-limit bank deposits at commercial banks nation-wide as proposed by local bank). All interest will be paid back to UNDP.
- Risk sharing mechanism among banks and borrowers.

ix. Roles of Institutions in managing the GEF Grant allocated for LGFS: This section lays down some principal roles and responsibilities of relevant parties involving operation of the LGFS during the project period. These roles and responsibilities will be further detailed into agreements/MoU and the operational mechanism of the LGFS.

a. UNDP Country Office:

- Have authority to approve the LGFS operational plan, financial plan, and the operational regulations and criteria of LGFS;
- Manage the total capital US\$ 250,000 of LGFS granted by GEF and transfer to LGFS in stages as work plan prepared and requested by PMU and in consistence with the approved operational and financial plans and results of monitoring and evaluation of LGFS;
- Participate in the Stove and Kiln Project Appraisal Committee;
- Have the authority to regularly check the usage of LGFS money deposited at the local bank and reserve the right to withholding or withdrawing money already deposited to the LGFS subject to detection of fault or misuse of the GEF resources.

b. MOE/PMU:

- MOE will be held accountable to UNDP and the Government of Sierra Leone for the proper and effective use of the GEF grant deposited in the LGFS;
- MOE will sign the MOU on LGFS management with local bank;
- Prepare the LGFS operational strategy, financial plan as well as its operational regulations and criteria;
- Supervise and ensure the LGFS 's activities according to its regulations and criteria as well as decision of the NPD;
- Provide technical assistances to involved parties in operating the guarantee fund as needed;

- Participate in the Stove and Kiln Project Appraisal Committee;
- Have the authority to regularly check the usage of LGFS's money deposited at the local bank;
- MOE in collaboration with UNDP and Social Business Programme, is responsible for development and implementation of an exit strategy for transfer of the GEF grant for LGFS to the Government Treasury at the end stage of the project as a revolving fund.

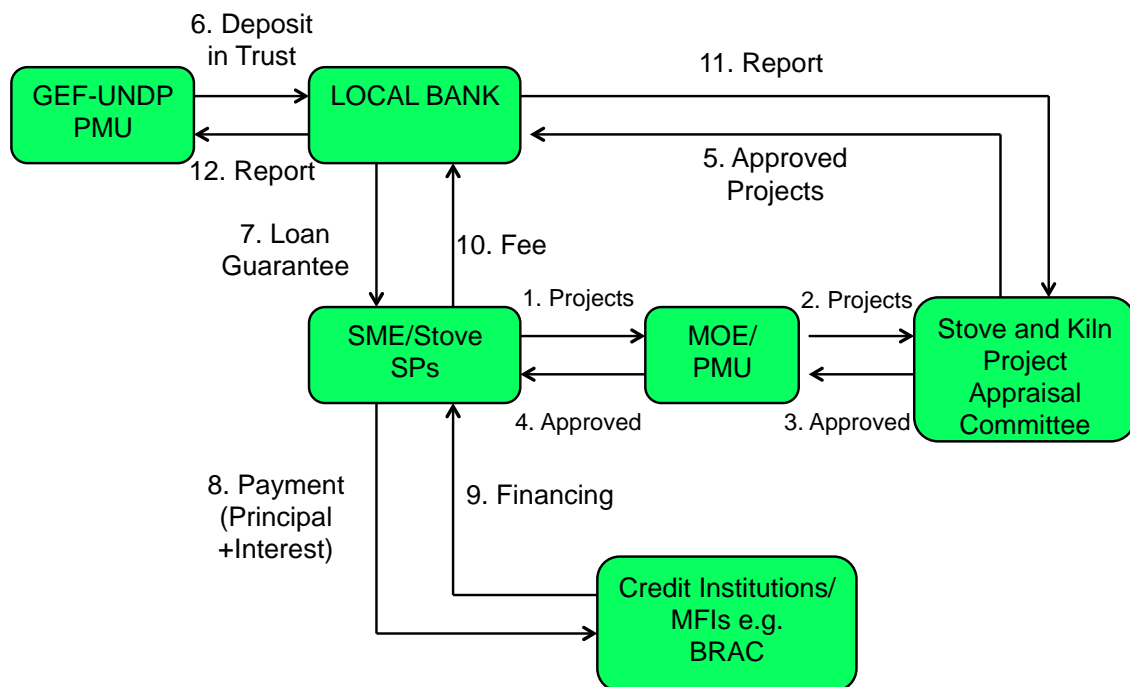


Figure 9: Implementation procedures for the Loan Guarantee Fund

c. LOCAL BANK – e.g. Rokel Bank, Standard Chartered Bank, EcoBank:

- Manage the LGFS in accordance with Sierra Leonean Law and the Provisions of MOU signed between local bank and MOE;
- Participate in the Stove and Kiln Project Appraisal Committee;
- Submit the quarterly and annually reports on their operation to PMU.
- Have responsibility to submit all needed information as required by UNDP and MOE. The Fund used by LGFS will be checked two times a year. The information should be provided as follows:
 - Verifications of guarantee issued from LGFS;
 - Total amount to be transferred to credit banks to cover the bad debts;
 - Total guarantee fee collected from SMEs as beneficiaries; and
 - Total income from collected interest for LGFS money deposited in local bank.

d. Exit Strategy

During the final year (Year 4), the Project will prepare a sustainable follow-up plan that will detail how to continue the LRGS after the end of the project-life – to attract public and private financing and leverage carbon finance in order to continue and scale-up the project in Sierra Leone.

4. Carbon Finance and Standardized Baselines for Sustainable Charcoal Business

Currently the charcoal sector is largely informal and unregulated, although there exist a number of relevant regulations scattered among different ministries and government agencies. This makes charcoal production unattractive to many potential investors and is a deterrent to serious investors in the sector. Attracting investment into the sector requires innovative approaches. Both the National Energy Policy and Energy Strategy (2009) in Sierra Leone highlight increased investment in renewable energy as one of the key policy targets. Carbon finance, the process, by which projects in developing countries or countries in transition can receive funding from industrialized countries or companies to meet the costs for projects that meet certain national and/or sectoral development goals and ultimately help the global reduction of greenhouse gas emissions, is seen as one of these innovative approaches.

The Charcoal NAMA report¹⁶ concludes that there exist opportunities exist both in the compliance (CDM) and voluntary carbon markets for the charcoal sector. It explore various options for doing this and recommends that the small-scale CDM methodology AMS-III.BG: “Emission reduction through sustainable charcoal production and consumption” is the most suitable methodology as it has all the elements present in the current project:

- Envisages small-scale charcoal production
- Involves shifting from non-renewable to renewable biomass feedstock
- Allow a range of charcoal kilns
- Promotes formation of charcoal associations for easier contracting
- Methane capture may or may not be undertaken as a project activity

In order to reduce high upfront transaction cost, this could be used in conjunction with the Standardized Baseline¹⁷ (SB) approach to simplify the process, following proposals submitted to the CDM Executive Board in 2012 and currently undergoing the second stage of review pending approval. As a phasing-out plan for obsolete technology and based on the lessons learned from the Ugandan experience, Output 2.6 will support the DNA in Sierra Leone in collaboration with UNDP’s MDG Carbon Programme to explore the feasibility to scale up efficient cookstove and efficient charcoal production as Programmes of Activity under the voluntary carbon market or as NAMA project.

The first step in developing the carbon finance aspect of the project is to organize the project beneficiaries into associations so that the carbon benefits can be aggregated to make project development feasible. This also makes easier the process of contracting – carbon finance involves a lot of contractual arrangements in order to manage risks associated with permanence of emissions reductions and to ensure their integrity. Once this has been done, the steps outlined in Table 28 will need to be supported following established procedure as elaborated in the table below.

Table 28: Basic steps in implementing a carbon finance project

Step/Activity	Significance	Issues to be Addressed
Step 1: Feasibility Assessment	To establish the financial viability of the charcoal enterprise from feedstock production to the final	<ul style="list-style-type: none"> • Is there a viable market to sell the charcoal and increase sales, is sustainable charcoal a profitable

¹⁶

http://www.undp.org/content/dam/undp/library/Environment%20and%20Energy/MDG%20Carbon%20Facility/CharcoalNAMAstudy_9Jan2013.pdf

¹⁷ The rationale behind standardized baselines is that baseline technologies, baseline emission factors and additionality criteria are not determined on a project-by-project level but are established for a project type or sector in one or several CDM host countries in order to save on high upfront transaction cost.

	product.	<p>enterprise?</p> <ul style="list-style-type: none"> • What is the baseline for charcoal demand? • What is the charcoal use patterns including end use technologies? • Is there a sufficient amount of emissions reductions for which the beneficiaries could receive carbon finance? • What is the difference between the present and expected situations?
Step 2: Baseline study and selection of methodology	To establish that the baseline scenario (current technologies, feedstock sources, etc.) represent an undesirable outcome in the long run if no remedial action is undertaken.	<ul style="list-style-type: none"> • How much emissions result from unsustainable biomass use? • How much emissions result from inefficient carbonization technologies • What is the outlook in the without-project scenario? • What is the outlook for with-project scenario? • What is the best methodology (carbon standard) to use to account for all these?
Step 3: Leakage Assessment and Development of Monitoring Plan	Develop a framework for monitoring the emissions reductions and the social, economic and environmental benefits of the project. Leakage assessment estimates the displacement of GHG emissions from one place to another due to emission reduction activities introduced by the proposed project. There is a need to put in place mechanisms for monitoring leakage (Henders & Ostwald, 2012).	<ul style="list-style-type: none"> • What system works best? • What data needs to be collected and how will this be done? • How frequent is the data collection? • Who will collect the data?
Step 4: Project Documentation	The data collected will be consolidated into a Project Design Document (PDD) following procedures and formats prescribed in the selected carbon standard, and which includes all calculations and their references. This document is also the basis of independent validation and if successfully granted registration, subsequent verification before carbon credits can be awarded.	<ul style="list-style-type: none"> • Can all the data required in the PDD be obtained and presented in the correct format? • What is the crediting period? • Is there project Additionality?
Step 5: Independent validation of calculations and registration	The Project Design Document (PDD), including the baseline, the estimated CO ₂ savings and the monitoring plan, will need to be checked and approved by an	The project technical consultant will need to work with the independent validator/verifier, helping clarify issues and effecting changes in design as advised by the validator.

	independent validator to establish conformity with the requirements of the selected carbon standard.	
Step 6: Implementation, ongoing monitoring and verifications	Good record keeping is crucial to ensure compliance with the approved PDD and as proof during verification before carbon payments can be made.	<ul style="list-style-type: none"> • Have the projected emissions reductions been achieved? • Is there need to adjust any aspects of the project based on the monitoring data?

Approach for developing Standardized Baseline in Project Area

1. An approach that has been developed in Uganda will be used to develop a standardized baseline for sustainable charcoal in the pilot districts, taking into account the fact that currently there is no consensus on an appropriate approach for developing SBs. Table 29 below gives a proposed approach based on practical site specific input which will put in place a reliable and tested charcoal baseline which is replicable across the districts in Sierra Leone. The **system boundary** within which the project activity takes place has been determined and comprises those emission sources that are significant, measurable and under the control of project participants in the pilot districts. The emissions that would have taken place within the system boundary without the carbon project have been described, making it possible to determine a baseline scenario and additionality. Justification for **physical boundaries** is based on carbon impact of charcoal activities and relative ease of measuring emission levels. The **aggregation levels** for the standardized baseline have been set for both accuracy and cost-effectiveness and will be based on analysis of *production process*; cross-comparison of efficiencies among different *ecological zones*, *duration* of carbonization and time series analysis with regards to *technology evolution*. To facilitate monitoring and ensure accuracy of the SB, there will be need to identify and establish **Performance Benchmarks**, which will be carefully tracked using suitably defined key performance indicators (KPIs). The KPIs will typically comprise easily observable and measurable outcomes resulting from proposed project activities.
2. Steps for developing SB are summarized in Table 29. Key performance indicators (KPIs) for the SB will be measured and evaluated through the monitoring of:
 - Efficient harvesting and conversion technologies
 - Change in cultural practice to include better preparation of feedstock prior to carbonization
 - Rate of absorption of technology
 - Amount of charcoal per unit of feedstock
 - Income generated from charcoal sales
 - Revenue generated including revenue to the district governments in form of taxes. This may also include revenue from auxiliary activities depending on the system boundary adopted, which in turn is dependent on the practicality as well as cost-effectiveness of data collection.
 - Emission reduction levels

Table 29: Summary of Steps for Developing Standardized Baselines

Crucial Elements	Activities	Data Requirements	Remarks/Comments
Establishment of System Boundary	Baseline and situational analysis in the pilot districts	Charcoal production, feedstock, conversion technology, relevant policy, stakeholder analysis etc	Data updating on-going There is availability of most of the data. Piloting of technology and full value chain will firm up existing data/information
Justification for	Relative carbon impact of charcoal	Relative ease of	Detailed analysis

Physical Boundaries Selected	related activities	measuring emission levels/impact of the different activities	of the relationships between different activities to be carried out
Aggregation level: Criteria for identification of peers for the emission performance comparison	Analysis of production process; cross-comparison of efficiencies among different ecological zones; carbonization time; Time series analysis with regards to technology evolution	Data on harvesting; feedstock source and preparation; carbonization method; recovery efficiency; historical analysis of available technology	Manageable levels of aggregation which are amenable to monitoring will be adopted.
Key Performance Indicators (KPI)	Monitoring of: Efficient harvesting and conversion Change in cultural practice to include better preparation of feedstock Rate of absorption of technology Amount of charcoal per unit of feedstock; Income generated And genera revenue to the district Emission level		

ANNEX D: Terms of Reference of Key Project Personnel

1. Project Board

The Project Board (PB) will be established to provide high level guidance and oversight to the Project. The PB will be responsible for making management decisions on a consensus basis for the Project when guidance is required by the Project Manager, including approval of project revisions. Project assurance reviews will be made by the PB at designated decision points during the running of a project, or as necessary when raised by the Project Manager.

The Project Board will play a critical role in project monitoring and evaluation by quality assuring these processes and products, and using evaluations for performance improvement, accountability and learning. It will ensure that required resources are committed and will arbitrate on any conflicts within the Project or will negotiate a solution to any problems with external bodies. In addition, it will approve the appointment and responsibilities of the Project Manager and any delegation of its Project Assurance responsibilities. Based on the approved Annual Workplan, the Project Board can also consider and approve the quarterly plans (if applicable) and also approve any essential deviations from the original plans.

In order to ensure UNDP's ultimate accountability for the project results, Project Board decisions will be made in accordance to standards that shall ensure management for development results, best value for money, fairness, integrity, transparency and effective international competition. In case consensus cannot be reached within the Board, the final decision shall rest with the UNDP Project Manager.

Potential members of the Project Board will be reviewed and recommended for approval during the UNDP Project Appraisal Committee (PAC) meeting. Representatives of other stakeholders may be included in the Board as appropriate.

The Project Board (PB) shall be comprised of the following:

- The Director General of Department of Energy, who shall be the Chairman of the PB
- A representative from MLCPE, MFED, MTI
- A representative from MAFFS
- A representative from UNDP
- A representative from Cooking Energy Stakeholder Group and Charcoal Producers Association
- The Project Director (who shall act as the PB Secretary)
- The Project Manager (who shall be a non-voting member of the PB)
- Representative(s) from private sector
- Representative(s) from co-financing donors

The PB will convene at least four times in a year (at the inception phase, at the mid-term phase and at the end of the project period) and on a need basis when required and called upon by the chairman.

The PB will have the following functions:

- Oversee and advise on the execution of the Project
- Monitor and supervise implementation of the Project
- Endorse the work plan
- Approve adaptations to the Project components during the Project execution, if any Evaluate the performance and impacts of the Project

- Approve Progress, Midterm and Terminal Reports of the Project

2. Project Manager

Under the direct supervision of the UNDP CO Head of Poverty Reduction and Environment & Energy Unit, and in close cooperation with the Programme Officer and National Project Coordinator (NPC), the Project Manager is responsible for the day-to-day management and implementation of the UNDP-GEF project, including all project administrative matters. All work of the Manager will be carried out in line with the Country Programme Action Plan and in full compliance with the UNDP Rules and Regulations. The management and coordination process will be pursued through undertaking appropriate actions in programme formulation, implementation and evaluation. Strong emphasis will be made on ensuring cohesion with other UNDP programmes.

Job content

- i. Manage the project implementation in accordance with objectives, schedule and planned budget;
- ii. Manage all project activity, staff, consultants and etc., for timely implementation of requirements on Monitoring and Evaluation;
- iii. Coordinate awareness creation on all project activities;
- iv. Coordinate the project activities with relevant activity and initiative of the Government;
- v. Ensure cooperation between the participating institutions of the project;
- vi. Ensure timely preparation of annual project reports, working plans and other relevant project documents.

Qualifications

At least 10 years work experience in project management. Previous work in international project management is an advantage

- University education in Engineering, Energy, Physics, Business Management or relevant field. A post-graduate degree (MSc, MPhil, PhD etc) is an advantage
- Strong interpersonal and communication skills
- Ability to take decisions
- Strong computer skills (Microsoft Office)

3. Administrative and Finance Assistant

The Administrative and Finance Assistant will work under the direct supervision of the Project Manager and provide assistance to the project implementation in the mobilization of inputs, the organization of training activities and financial management and reporting.

Job content

- (i) Prepare all payment requests, financial record-keeping and preparation of financial reports required in line with NEX financial rules and procedures
- (ii) Assist in the recruitment and procurement processes, checking the conformity with UNDP and the Government rules and procedures
- (iii) Assist in the organization of in-country training activities, ensuring logistical arrangements
- (iv) Prepare internal and external travel arrangements for project personnel
- (v) Maintain equipment ledgers and other data base for the project
- (vi) Take record of projects meetings and draft correspondence as required

- (vii) Maintain project filing
- (viii) Other duties which may be required

Qualifications

At least five years administrative experience,

- University degree in Business Administration (Finance or Accounting)
- Good organizational skills
- Good computer skills, including spread-sheets and database

4. International consultant – International Technical Advisor – Project Management

Job content

- i. To serve as part-time ITA to provide overall technical guidance, advice and back-supporting to Project Coordinator and project team
- ii. Assist the Project Coordinator and project team to prepare a detailed Annual Work Plan of all project activities in line with the programming and approved budget, and start and conclude them accordingly;
- iii. Advise the Project Coordinator and project team on the project strategy and implementation methodology;
- iv. Assist in the recruitment, supervision and management of local staff;
- v. Participate in the recruitment of local consultants and international experts;
- vi. Conduct mission to project sites on a quarterly basis.

Qualification

At least 5 years work experience in project management. Previous work in international project management is an advantage

- University education in engineering, energy, physics, business management or relevant field. A post-graduate degree (MSc, MPhil, PhD etc) is an advantage
- Strong interpersonal and communication skills
- Ability to take decisions
- Strong computer skills (Microsoft Office, Internet, e-mail)

5. International Consultant for Mid Term evaluation

The International Consultant will be recruited to conduct the Mid-term Evaluation of the Project. S/he will report to the Project Manager and act as the team leader for the following specific tasks:

- Provide guidance to the National Consultant in conducting the Mid-term Evaluation.
- Assess the progress towards achievement of the project objectives as outlined in the approved Project Document.
- Look into the linkages between this project and other relevant projects/agencies and assess their effectiveness.
- Assess the structure and performance of the project management team and support provided by GEF-UNDP.
- Identify lessons learned from the implementation of the project's activities.
- Provide guidance and specific recommendations on how the project team and UNDP can improve performance (both substantive and management) during the remaining duration of the current project.
- Provide guidance and specific recommendations for future support in the area of climate change mitigation and renewable energy for both the GoSL and UNDP to consider.
- Produce the Mid-term Evaluation Report.
- Present the findings to relevant stakeholders.

Qualifications:

- Familiarity with climate change challenges in developing countries; previous experiences related to renewable energy and particularly biomass energy would be an advantage.
- 10 years of relevant field-based experience in monitoring and evaluation of projects.
- Familiarity with a participatory approach in project monitoring and evaluation.
- Familiarity with Sierra Leone or similar countries.
- Excellent writing and analytical skills.

6. National Consultant for Mid Term Review

The National Consultant will be recruited to conduct the Mid-term Evaluation of the Project. S/he will report to the Project Manager and support the International Consultant for the following specific tasks:

- Liaise with local stakeholders to ensure that cultural perspectives and local circumstances are taken into account and incorporated into recommendations.
- Assess the progress towards achievement of the project objectives as outlined in the approved Project Document.
- Look into the linkages between this project and other relevant projects/agencies and assess their effectiveness.
- Assess the structure and performance of the project management team and support provided by GEF-UNDP.
- Identify lessons learned from the implementation of the project's activities.
- Provide input on how the project team and UNDP can improve performance (both substantive and management) during the remaining duration of the current project.
- Provide inputs on specific recommendations for future support in the area of climate change mitigation and renewable energy for both the GoSL and UNDP to consider.
- Provide inputs to the International Consultant in preparing the Mid-term Evaluation Report.
- Present the findings to relevant stakeholders.

Qualifications:

- Understanding of climate change mitigation and renewable energy in Sierra Leone.
- At least 5 years of work experience in the development sector in Sierra Leone.
- Excellent communication skills in English (oral and written).

7. International Consultant for Final Evaluation

The International Consultant will be recruited to conduct the Final Evaluation of the Project. S/he will report to the Project Manager and act as the team leader for the following specific tasks:

- Provide guidance to the National Consultant in conducting the Final Evaluation.
- Assess the progress towards achievement of the project objectives as outlined in the approved Project Document.
- Look into the linkages between this project and other relevant projects/agencies and assess their effectiveness.
- Assess the structure and performance of the project management team and support provided by GEF-UNDP and to what extent recommendations from the Mid-term Evaluation were implemented.
- Identify lessons learned from the implementation of the Project's activities in the following areas:
 - Relevance – the extent to which the activity is suited to local and national development priorities and organizational policies, including changes over time
 - Effectiveness – the extent to which the project objective has been achieved or how likely it is to be achieved

- Efficiency – the extent to which results have been delivered with the least costly resources possible
 - Results – the positive and negative, and foreseen and unforeseen, changes to and effects produced by a development intervention. In GEF terms, results include direct project outputs, short-to medium term outcomes, and longer-term impact including replication effects and other, local effects
 - Sustainability – the likely ability of an intervention to continue to deliver benefits for an extended period of time after completion. Projects need to be environmentally as well as financially and socially sustainable.
- Provide guidance and specific recommendations for future support in the area of climate change mitigation and renewable energy for both the GoSL and UNDP to consider.
 - Produce the Final Evaluation Report.
 - Present the findings to relevant stakeholders.

Qualifications:

- Familiarity with climate change challenges in developing countries; previous experiences related to renewable energy and particularly biomass energy would be an advantage.
- 10 years of relevant field-based experience in monitoring and evaluation of projects.
- Familiarity with a participatory approach in project monitoring and evaluation.
- Familiarity with Sierra Leone or similar countries.
- Excellent writing and analytical skills.

8. National Consultant for Final Review

The National Consultant will be recruited to conduct the Final Evaluation of the Project. S/he will report to the Project Manager and support the International Consultant for the following specific tasks:

- Liaise with local stakeholders to ensure that cultural perspectives and local circumstances are taken into account and incorporated into recommendations.
- Assess the progress towards achievement of the project objectives as outlined in the approved Project Document.
- Look into the linkages between this project and other relevant projects/agencies and assess their effectiveness.
- Assess the structure and performance of the project management team and support provided by GEF-UNDP and to what extent recommendations from the Mid-term Evaluation were implemented.
- Identify lessons learned from the implementation of the project's activities in the following areas:
 - Relevance – the extent to which the activity is suited to local and national development priorities and organizational policies, including changes over time
 - Effectiveness – the extent to which the project objective has been achieved or how likely it is to be achieved
 - Efficiency – the extent to which results have been delivered with the least costly resources possible
 - Results – the positive and negative, and foreseen and unforeseen, changes to and effects produced by a development intervention. In GEF terms, results include direct project outputs, short-to medium term outcomes, and longer-term impact including replication effects and other, local effects
 - Sustainability – the likely ability of an intervention to continue to deliver benefits for an extended period of time after completion. Projects need to be environmentally as well as financially and socially sustainable.

- Provide inputs on specific recommendations for future support in the area of climate change mitigation and renewable energy for both the GoSL and UNDP to consider.
- Provide inputs to the International Consultant in preparing the Final Evaluation Report.
- Present the findings to relevant stakeholders.

Qualifications:

- Understanding of climate change mitigation and renewable energy in Sierra Leone.
- At least 5 years of work experience in the development sector in Sierra Leone.
- Excellent communication skills in English (oral and written).

9. Component Team Leader, DOE

The DOE is responsible for the execution of Component 1, 2, and 3 and jointly responsible with FD for the execution of Components 1 and 2. The DOE will appoint and provide a Component Team Leader who will lead the staff assigned by the DOE in performing the activities that are under its responsibilities. The Component Team Leader will play a key role in project execution and will report to the Project Manager of EEPUC. The Component Team Leader will be in charge and responsible for the following:

- Coordinate project implementation, monitor work progress, and ensure timely delivery of specific outputs under Component 1, 2 and 3.
- Liaise with the Project Manager and FD to jointly execute project implementation, monitor work progress, and ensure timely delivery of outputs.
- Liaise with CBOs, fabricators, village technicians and rural households to finalize the mechanisms and agreements for their participation in the promotion, construction, dissemination and monitoring of efficient stoves and kilns applications.
- Prepare a detailed work plan for the project at the outset of implementation, in coordination with the Project Manager and FD, and revise it at least annually.
- Organize and conduct stakeholders meetings, technical trainings, and other events as necessary.
- Assist in the identification, selection and recruitment of consultants and other experts for the outputs under DOE responsibility.
- Supervise, coordinate, and facilitate the work of all national and international consultants retained for the different activities related to the outputs listed above and provide inputs to these consultants, whenever required.
- Participate in PMU meetings, follow up on the outcomes of such meetings and report on progress related to the outputs under DOE responsibility.
- Prepare technical specifications for equipment required for the project and manage procurement for outputs under DOE responsibility.
- Identify relevant, on-going activities by other government and non-government agencies and establish linkages.
- Build partnerships with international/regional institutions and national organizations.
- Prepare technical progress reports and other monitoring reports as described in the M&E plan for outputs under DOE responsibility. Reports should contain assessments of progress in implementing activities, including reasons for delays, if any, and recommendations on necessary improvements.

Qualifications:

- Understanding of climate change mitigation, renewable energy, biomass production and utilization and rural development in Sierra Leone and the main actors and stakeholders in this field.
- Proven experience with the implementation of development projects, particularly in the field of renewable energy.

- Proven ability to manage, monitor, and troubleshoot comparable projects.
- Excellent working knowledge of spoken and written English.
- Willingness to travel to different parts of Sierra Leone as appropriate.

10. Component Team Leader, DOE and FD

The FD is jointly responsible with DOE for the execution of Components 1 and 2. The FD will appoint and provide a Component Team Leader who will lead the staff assigned by the FD in performing the activities that are under their responsibilities. The Team Leaders will play a key role in project execution and will report to the Project Manager of EEPUC. The Component Team Leader will be in charge and responsible for the following:

- Coordinate project implementation, monitor work progress, and ensure timely delivery of Outputs 1.2 and 2.5
- Liaise with the Project Manager and FD to jointly execute project implementation, monitor work progress, and ensure timely delivery of outputs.
- Liaise with FD district officers, farmers managed agroforestry and rural households for activities related to sustainable fuel wood plantation and utilization.
- Prepare a detailed work plan for the project at the outset of implementation, in coordination with the Project Manager and FD, and revise it at least annually.
- Organize and conduct stakeholders meetings, technical trainings, and other events as necessary.
- Assist in the identification, selection and recruitment of consultants and other experts for the outputs under FD responsibility.
- Supervise, coordinate, and facilitate the work of all national and international consultants retained for the different activities related to the outputs listed above and provide inputs to these consultants, whenever required.
- Participate in PMU meetings, follow up on the outcomes of such meetings and report on progress related to the outputs under FD responsibility.
- Prepare technical specifications for equipment required for the project and manage procurement for outputs under FD responsibility.
- Identify relevant, on-going activities by other government and non-government agencies and establish linkages.
- Build partnerships with international/regional institutions and national organizations.
- Prepare technical progress reports and other monitoring reports as described in the M&E plan for outputs under FD responsibility. Reports should contain assessments of progress in implementing activities, including reasons for delays, if any, and recommendations on necessary improvements.

Qualifications:

- Understanding of forest management aspects, rural development and fuel wood plantation in Sierra Leone and the main actors and stakeholders in this field.
- Proven experience with the implementation of development projects, particularly in the field of sustainable forest management.
- Proven ability to manage, monitor, and troubleshoot comparable projects.
- Excellent working knowledge of spoken and written English.
- Willingness to travel to different parts of Sierra Leone as appropriate.

ANNEX E: List of Organizations Consulted During the Preparatory Phase

The following organizations were consulted during the project preparatory phase:

Public Sector

Ministry of Energy
Division of Energy
Ministry of Land, Country Planning and Environment
Ministry of Finance and Economic Development
Ministry of Local Government and Rural Development
Environmental Protection Agency
Ministry of Agriculture, Forestry and Food Security
Division of Forestry
Division of Livestock
Ministry of Education, Science and Technology

Professional Trade Associations

Charcoal Producers Association
Freetown Chamber of Commerce

Private Sector

BRAC (MFI)
WestWind Energy
Toyola Energy
Bockarie Enterprise
Samu Enterprise
Fish industry
Bakeries

Bilateral/Multilateral

UNDP
EU
WFP
FAO
GERES
ECREEE
ICRAF

NGOs

Energy For Opportunity
Environmental Foundation for Africa
WHL
Concerns International
World Visions

ANNEX F: Proposed Sustainable Household Energy Roadmap

This section sets out the proposed Sierra Leone household energy roadmap that was presented, discussed and endorsed by the National Stakeholders' Workshop in Freetown on 28th October 2013. Comments and suggestions made by the stakeholders at that workshop are incorporated throughout the EUEI-PDF report and the recommendations are incorporated in the design of this GEF funded project as incremental activities.

Table 6: Proposed Sustainable Household Energy Roadmap

Output and Activity	Who
1.1. Identify and set up four sustainable forestry (as either commercial forest and/or community forest) woodland supply pilot enterprises (public-private partnerships between LAs, chiefs, producer associations & landholders as joint ventures)	MLGRD, MLCPE, FD/MAFFS, EPA-SL, MSWGCA, with support, funding from EU EPA-SL, UNDP/GEF, ICRAF, STEWARD, CARE, WHH, producer associations, Chiefs, LAs, landholders, CBOs.
1.2. Provide training & capacity building to pilot enterprises & support agencies on business skills, accounting, marketing, etc.	MLGRD, MTI, Min. of Labour, NGOs, producer associations, Chiefs, LAs, landholders, CBOs.
1.3. Monitor and Evaluate the Pilot Sustainable Charcoal Enterprises	MLGRD, MLCPE, FD/MAFFS, EPA-SL, MSWGCA, with support, funding from EU EPA-SL, UNDP/GEF, ICRAF, STEWARD, CARE, WHH, producer associations, Chiefs, LAs, landholders, CBOs.
2. Set up National Cooking Energy Stakeholder Group (CESG)	MOE, OP-SPU, MAFFS, FD, MLGRD, MLCPE, EPA-SL, MSWGCA, Private sector (1), development partner (2 including ECREEE), GERES, NGO, regional reps (4)
3. Agree on the Roadmap and the Key Actions	MOE, OP-SPU, MAFFS, FD, MLGRD, MLCPE, EPA-SL, MSWGCA, Private sector (1), development partner (2 including ECREEE), GERES, NGO, regional reps (4)
4. Update 2009 National Energy Plan & National Energy Strategy with National Cooking Energy Action Plan (ECEEE assistance)	MOE, ECREEE, GERES, FD/MAFFS, MSWGCA, UNDP/GEF, EU EPA-SL, MLGRD, MLCPE, other household energy stakeholders.
5. National Cooking Energy Forum and Exhibition (ECEEE, GIZ)	MOE, ECREEE, FD/MAFFS, MSWGCA, GERES, UNDP/GEF, EU EPA-SL, MLGRD, MLCPE, other household energy stakeholders, media.
6. Awareness Raising	MLGRD, MAFFS, FD, MLCPE, EPA-SL, MOE, local government, Paramount Chiefs, CBOs/NGOs, media
7. Improving Efficiency of Wood Energy End Use	MOE, ECREEE, GERES, UNDP/GEF, EU EPA-SL, NGOs, private producers
8. Support alternative energy sources, including LPG, biomass briquettes, and other biomass fuel sources.	MOE, ECREEE, Private Sector

The **recommended road map** has eight (8) recommended Outputs (activities 1 to 76, below, with Output 1 having 3 components).

Output 1: Sustainable Forest Energy Enterprises

Activity 1.1: Identify, Establish, Implement, Monitor & Evaluate

Objective and outcome:

- The primary objective of each enterprise is to test a model for sustainable charcoal production, whereby producers will have access to, and management of, forest land (on tribal land in Northern, Southern and Eastern Regions, freehold land in Western Region). They will manage the woodland to produce wood on a sustainable basis for improved, efficient charcoal production on a commercial basis.
- The models will be to demonstrate whether providing charcoal producing groups with access to forests, with obligations to manage and harvest trees on a sustainable basis can work and be profitable. Currently local authorities, chiefs, landholders and the FD must approve production of charcoal on lands they control, and receive some form of payment for harvesting wood and producing charcoal on and from that land...
- The pilots are intended to provide each stakeholder with a more transparent, commercial and partnership role to align the interests of all parties to ensure commercially viable production of charcoal on a sustainable basis.
- Four pilot sustainable forestry energy enterprises will be set up, one in each region of the country. They will be set up for a minimum of 20 years, to enable at least two, if not three full tree rotations and harvest.
- These enterprises will be set up as public-private partnerships between local district councils, local chiefs (on tribal land – Northern, Southern and Eastern Regions), well-organized and successful charcoal producer associations, local landholders (on the land that will be used for the pilots), and possibly local business people.
- These enterprises will be set up as commercial joint ventures in which each participant group will have shares in the enterprise, with certain agreed rights and responsibilities (e.g., overall management, forest management and charcoal production, technical assistance and training, etc.).
- Each partner will receive a share of the proceeds, as a shareholder and for any services they might provide (e.g., rent on the land, payment for accounting services, fees, taxes, etc.)

The PSCEC will follow several steps to identify the target pilot enterprises:

- The PSCEC will come up with a set of criteria for selecting the districts, and the producer associations for the enterprises.
- Criteria for associations should include:
 1. Willingness to participate;
 2. More than ten members in the producer association;
 3. More than three years' operation as a producer association;
 4. Experience of some members of the association in forest management;
 5. Degree of organization of the producer group;
 6. Experience in working with local councils and other institutions, such as the FD; and,
 7. Local reputation.

Experience of some members in the producer associations or groups with **forest/woodland co-management**, joint forest management (of any sort, public private, and private-private), community-based forestry management (CBFM) and/or participatory forest management (PFM) would be an added ranking criterion. Any experience by members of the producer group of afforestation, tree planting, and woodlots would be a strong additional ranking criterion.

The MLGRD and the FD will hold sessions in each district with district councils, district chief councils, local landholders and local producer groups, with local NGOs/CBOs, much of the size and type as the RECP/EUEI PDF regional stakeholder meetings of July 2013. This will be to present the concept, the criteria for selection and to stimulate discussion, welcoming any recommendations on the establishment and operations of the pilots.

During this process of awareness raising, each district will be rated by MAFFS/FD and the MLGRD, in consultation with the MOE, with NGOs/CBOS active in the area of sustainable forestry (e.g., ICRAF), and other on-the-ground institutions.

On the charcoal side, it is hoped that the EPA-SL, through their EU-funded “REDD+ capability Building Project” (with its strong focus in “Element 4” of the project document on working with the FD and local communities on improving charcoal production and woodland management for such), and the EU-funded “Environmental Governance and Mainstreaming Project” could provide some funding through the EPA-SL for Activities 1.1 and 1.2 of this roadmap. Further, there could be opportunities, of tapping into the upcoming GEF/UNDP charcoal project.

Activity 1.2: Provide training and Capacity Building to these Enterprises

- **Objective and outcome:** The proposed pilot enterprises will become operational, commercial and sustainable. Each pilot will require technical training in such fields as forestry management, sustainable harvesting, improved charcoal production, business development, among others. Most of this training will be at the beginning of each pilot. The type and amount of training will depend upon the partners, their experience and roles. The desired outcome is that, within a short while (e.g., four years), each pilot enterprise will be commercially viable, and producing their charcoal from sustainable forest resources.

Thereafter, they will require limited specialist input and support. These pilots will be monitored and documented carefully by the Committee and by one consultant hired specifically to undertake the monitoring and evaluation. The purpose of this will be to develop case studies, with extensive examples, to be used to provide working models for other similar enterprises to replicate throughout Sierra Leone.

- **Implementation strategy:** There are several different types of capacity building and training that will be necessary for these enterprises, including:
 1. **Business Skills** – How to work as a Joint Venture Enterprise (Ministry of Trade & Industry);
 2. **Technical Skills in the Area of Forestry** Management, Sustainable Harvesting, Tree Species Selection, Operations of Nurseries, Replanting (FD, forestry NGOs/CBOs such as ICRAF, BioClimate, CARE, WHH, etc.)
 3. **Technical Skills (for charcoal) in Improved Charcoal Production**, Including Wood Harvesting and Cutting, Drying, Kiln Design, Construction and Operations – Efficiency Improvements to Maximize Output with Least Input. (MOE, FD)
 4. **Technical Skills for Commercial Wood Fuel in Wood Harvesting**, Collection, Bundling (FD, NGOs);
 5. **Operational and Management Skills** – How to Set up a Successful Business and Manage a Variety of People from Different Backgrounds (MLSS, MTI);
 6. **Commercial Skills including Accountancy, Bookkeeping and Commercial Operations** (MLGRD, MLSS, MTI);
 7. **Marketing of Production including any Branding** (MTI, NGOs)

Activity 1.3: Monitor and Evaluate the Pilot Sustainable Charcoal Enterprises

- **Objective and outcome:** If the sustainable charcoal enterprise pilots are successful, they should be replicated in a number of other districts. Given the dynamism of the producer associations, the interest of local governments and chiefs, the interest of Central Government, if the pilots are successful, there should be autonomous development of other biomass energy enterprises elsewhere in the country.
- **Implementation strategy:** The PSCEC, working with the other stakeholders, will ensure that the pilots are monitored and evaluate, and that the results and lessons learned are disseminated through their agencies and organizations.
- **Required time, resources and potential funding sources:** This will be an ongoing process, with benchmarks for evaluation twice during Year 1, then every year, with particular attention paid to Year 6, which should be the time when first planted or replanted trees, or a managed harvested stand of trees, reach maturity for sustainable harvest.
- **Lead governmental body and stakeholders involved:** PSCEC with MLGRD and FD/MAFFS taking the lead on the dissemination, and Committee members, with the district councils and chiefs who are participating, the producer associations and the enterprises that have been established.

GEF incremental values: All these recommendations will be implemented with ICRAF and EU-REDD+ project under Output 2.4.

Output 2: National Cooking Energy Stakeholder Group (CESG)

- **Objective and outcome:** The objective of forming and operating the National Cooking Energy Stakeholder Group is to set up a multi-stakeholder, multi-disciplinary body to:
 - Review, modify and approve the National Household Energy Roadmap; and,
 - Co-ordinate and guide the implementation of the update of the household components of the 2009 National Energy Plan and National Energy Strategy under the National Cooking Energy Action Plan; and,
 - Review progress towards achieving the recommendations in the Roadmap (Steps 5 to 8).

The CESG should be headed up by the Ministry of Energy, as the coordinating body, as set out in the 2009 National Energy Policy and National Energy Strategy. The CESG should have a fixed lifespan (say, one, maximum two years). Additionally the CESG will act as the body to work with development partners to secure finance and technical assistance for key activities.

- **Implementation strategy:** The Ministry of Energy should chair the CESG and invite:
 - the Office of the President's Strategy and Planning Unit's (e.g., Energy and Infrastructure Advisor);
 - MAFFS (e.g., Deputy Minister);
 - the Conservator of Forests (Director of the FD, MAFFS);
 - MLGRD (e.g., the Deputy Minister);
 - Ministry of Lands/MLCPE (e.g., Deputy Minister);
 - Executive Director of the EPA-SL;
 - Head of Gender Section, MSWGCA
 - Private sector representative (1) who is most active in, and representative of, the household energy sector, particularly biomass energy (e.g., charcoal association, stove producers association, wood and charcoal sales association);
 - Two development partner representatives who are the most active in the forestry and environment fields (e.g., FAO, EU Delegation);
 - ECREEE
 - GERES
 - Representative (1) of NGOs most active in the sector; and,
 - One representative from each of the four regions (selected by each regions).

This results in 15 representatives for the CESG. Of course, the CESG can agree to co-opt any additional members on a temporary or permanent basis.

GEF incremental values: These recommendations have been considered under Output 1.1.

Output 3: Agree on the Roadmap and the Key Actions

- **Objective and outcome:** The first activity of the CESG will be to review this recommended roadmap and the activities set out therein. They will formalize the roadmap and, as all bodies who are engaged in the implementation of the roadmap sit on the CESG, the CESG will be best-placed to coordinate those activities.
- **Implementation strategy:** Each component of the roadmap has discrete elements. The CESG will discuss each, and lay out an agreed strategy, defining who is responsible for what, for each element of the strategy (Output 4 to 8).

Output 4: Update 2009 National Energy Plan & Strategy with National Cooking Energy Action Plan

- **Objective and Outcome:** One of the first activities of the CESG under the lead of the Ministry of Energy and with support of ECREEE and its partners is the development of a framework for

Cooking Energy Action Plan for Sierra Leone. It has been pointed out by the various stakeholders that such a framework will have to adopt a two-pronged approach to:

- Define approaches to improve biomass cooking; and,
 - Identify and develop markets for alternative cooking fuels such as LPG, bio-ethanol, and other alternatives.
- ECREEE will support the MOE in developing a first draft of a action plan framework and will engage WACCA partners such as GACC who have developed such action plans in other countries of the region. The first draft is envisaged to be discussed in the frame of the cooking energy forum to be organised early 2014 in Sierra Leone.

GEF incremental values: All these recommendations have been considered under Output 1.1 and 1.2.

Output 5: National Cooking Energy Forum and Exhibition

Objective and outcome: A national cooking energy forum will be held in Sierra Leone in early 2014, sponsored jointly by the MOE and ECREEE. The Forum will seek to stimulate a constructive dialogue on the role of biomass cooking energy between the major stakeholders in Sierra Leone. Experts from ECOWAS will participate. Discussions will focus on the following issues:

- Latest developments and state-of-the-art cooking and fuel production technologies;
- Business models and stove product marketing;
- Experiences in sustainable wood energy production and supply chain;
- Identifying user needs and challenges of industry; and,
- Standards and testing of cook stoves

It is envisaged that participants will discuss a draft framework for Sierra Leone's cooking energy action plan. This will be developed with the support of ECREEE and GIZ, with technical support of the CESG).

The participants at the event will be representatives from Ministries and governmental organisations, researchers, NGOs, practitioners, stove producers/industries, cooking fuel producers, stove associations, implementing organisations, donors, and standard bodies and testing laboratories, development experts as well as consultants and service providers in the cooking energy sector. Experts from other countries of the ECOWAS Region will be invited to share experiences and lessons learned.

Alongside the national cooking energy forum, an exhibition will be organised to showcase practical examples and demonstrate products and technologies.

This Cooking Energy Forum will be organised with financial support of GIZ and possible further partners.

GEF incremental values: These recommendations have been considered under Output 3.

Output 6: Awareness Raising

- **Objective and outcome:** Essentially, there are two audiences in the awareness raising approach set out within the Roadmap: Local government and local stakeholders, on the one hand, and central government stakeholders on the other:
 - **Local stakeholders** are aware of what is happening in the area of forestry energy, who is involved, the scale of activities, the type of activities, and the positive and negative effects. As noted, local government understands the livelihood and economic aspects of charcoal production and the ecological effects. The awareness that needs raising at a local level is how national policy and regulations, what skills, techniques and technologies are available to support sustainable commercial forest energy.
 - **National-level government, many development partners and many international NGOs**, in particular, have historically viewed commercial biomass energy in relatively negative lights, both from an ecological and from an economic perspective. A key

component of awareness raising at a national level is to understand the important contribution biomass energy makes and will continue to make for many years, and the need to put in place the institutional and financial supports to make it as sustainable as possible.

For both national and local government, there are two elements of awareness raising, both of which are essential to the success of the activity. Firstly, to set out the existing policy framework in forestry, local government, and lands that both permit and support the development of sustainable local biomass energy activities, particularly setting up commercial biomass energy enterprises.

Secondly, it is important to raise the awareness of the general public on issues of, and opportunities for, improved forest management for biomass energy, improved efficiency of harvesting and of charcoal and/or firewood transformation, on the supply side, and efficiency of use and demand management, on the demand side. It is key to tackle both supply and demand simultaneously with the aim to slowing down the process of forest and woodland degradation and deforestation.

- Awareness raising in the Forestry Division is very important, given their key role on the supply side. The approach that is proposed here does not fit the framework within which most FD personnel have been trained and have operated for years. Given their lack of personnel and financial resources, particularly during and after the war, the FD has primarily focused upon enforcement of regulations, policing reserves, collecting fees and fines. Sierra Leone has little, and very recent, experience in PFM, CBFM and JFM (joint forest management) – i.e. social forestry.
- However, their role in a decentralized government system, where they report to local councils, receive their budgets from local councils and from locally-based activities, requires awareness raising on community and local, non-reserve, forestry.
- Decentralization means that the regional and district forest officers need to work closely with the councils and the communities. The proposed activities under this Roadmap are directly in line with the Forestry Policy, which calls for the necessity of engaging communities and enabling them to benefit from the forestry resources in a sustainable way. (MAFFS. 2010. See policy statements 3, 4 and 9, in particular).
 - The Ministry of Local Government and Rural Development need to bring together all district councils, all chiefs and all municipal and city councils:
 - The Ministry of Energy has responsibility for overall energy sector (supply and demand) efficiency improvement messaging, from improved household energy to improved production efficiencies.
 - The MAFFS and FD, have responsibility to raise awareness of the roadmap to move charcoal and commercial wood fuel to a sustainable level, and the roles community forestry and commercial (non-timber forest product) forestry will play in this.
- The **MAFFS and the FD** have a primary responsibility to work with Forest Division staff to raise awareness of what sustainable charcoal and firewood production is about, and how new community and commercial sustainable forest enterprises are in the FD's best commercial and administrative interests. It is important that they are aware of how this approach to forestry (wood energy as a non-timber forest product) fits within the Forest Act (GoSL, 1988) and, as importantly, the Forestry Policy (MAFFS, 2010).

The Project Team recommends that the “Forestry Advisory Committee”, which was set up under the Forestry Policy of 2010, but, which has never met, be activated to serve as a primary forum for forestry officers (central and local) and other stakeholders (local councils and chiefs, in particular) to raise awareness of the policy framework for non-timber forest products (in this case, fuel wood and charcoal) to be supported in a structured, regulated and technically sound manner.

Further, the Forestry Advisory Committee could serve to help the FD to set out their training, technical assistance and other support requirements to local councils and Central Government in order to carry out this proposed, new mandate.

- **Required time, resources and potential funding sources:** There are several elements to this component. One deals with awareness raising in Government (local and central). Once the strategy is agreed by the CESC, then, each institution should hold meetings with key staff, general staff and with field staff to apprise them of the approach, roadmap plan and strategy. This will serve both to raise awareness as well as to solicit ideas on how to improve it.

The second level of awareness raising is with local councils, chiefs and chiefdom councils. This is the responsibility of the Ministry of Local Government and Rural Development, with the MOE, Ministry of Lands, the FD and the EPA-SL actively involved in explaining the approach, raising awareness of the relevant laws and policies in local government, forestry, lands and environment that would support the proposed activities. The benefits of the approach and the proposed pilots will be discussed. As with government ministerial and agency briefings, comments and suggestions will be solicited from local government.

The third level of awareness raising is at a public, national level. This is an area that has been lacking in Sierra Leone, and one that requires use of mass-media, sensitization of civil society, development partners, NGOs and the private sector. This will effectively be the “kick-off” of the public face of the roadmap and will need to be thought through and implemented carefully.

However, it is critical to raise awareness, both so people understand what is happening on the supply side, what Government intends to do on supplies, and to begin the process of familiarizing the public on energy efficiency in the wood fuel sector. This will set the stage for future campaigns on, for example, improved stoves, as well as on improved charcoal, LPG and other alternatives to current non-sustainable charcoal.

GEF incremental values: All these recommendations have been considered under Output 3.

Output 7: Improving Efficiency of Wood Energy End Use

- **Objective and outcome:** To improve the efficiency of firewood and charcoal use in households, household enterprises and other consumer commercial enterprises and institutions. Optimally, over 50% of all urban households will be using improved charcoal stoves (ICS) and improved wood stoves within six years of the start-up of the activity. Average efficiency would be 50% improved over current devices or uses, implying a halving of firewood and charcoal consumption in the 50% of users who have switched to improved devices.
 - **Implementation strategy:** There are four elements to this component:
 - i. reconnaissance/testing on current charcoal stoves;
 - ii. scoping out urban wood stoves, or potential for improved urban wood stoves;
 - iii. identifying potential efficiency improvements in ovens, boilers other wood or charcoal burning devices used by household enterprises, and commercial and institutional enterprises; and,
 - iv. Support for improved stoves (or possibly design or importing of improved wood stoves), with selection of producers, training, technical assistance in both technical production and commercialization.
1. **Reconnaissance and Testing:** Currently a number of urban consumers believe they are using ICS, through the so-called “wonder stove”. The efficiency of this device is untested. Because of many manufacturers of both the ceramic (fired pottery) liner and the metal cladding, there may be considerable variation in efficiencies.
 - The first step of this component will be to identify the ten largest producers of “improved” charcoal stoves, and a sampling of another 5 to 10 “traditional” charcoal stoves. These can be tested basically using water boiling tests (WBT) very easily in Freetown to get “order of magnitude” performance readings.¹⁸

¹⁸ See this YouTube video on the so-called “wonder-stove”, based on the “Kenya Ceramic Jiko/KCJ”, technology imported to Sierra Leone by producers in the late-1980s. <http://www.youtube.com/watch?v=7hU8L3CsSvU>

- These same stoves should then be tested more rigorously in the laboratory on thermal efficiency, stress and other tests to determine their performance.
 - Those that perform the best, with the highest quality and the lowest prices should be selected for assistance in improving performance, appearance and other aspects such as commercialization.
2. **Potential Improved Urban Wood Stoves:** A key element of this strategy and potentially one of the major interventions, should be to determine if there are any wood burning stoves sold in urban markets in Sierra Leone. A quarter of Freetown households (approximately 100,000 households), and more than half of the households in Bo, Kenema, Bonthe, and Makeni currently use wood (estimated 150,000 households). Furthermore, a number of Freetown Rural – peri-urban households use firewood for cooking.
 - a. Therefore, we strongly suggest that this be a major area of initial research. The findings of this research on firewood cooking will guide future activities.
 - b. We suggest that, as urban firewood is commercial (people buy it), that there is potentially great scope for an urban/peri-urban improved wood cook stove that could have substantial health improvement and efficiency improvement effects.
 3. **Identify Possible Improvements in Ovens, Heaters, Kilns, Other Commercial-Institutional Wood and Charcoal Burning Devices:**¹⁹
 - a. Wood, in particular, is used in a variety of commercial and institutional areas, from water heating in hotels, to baking ovens, small ceramic kilns for household enterprises, particularly fish smoking, etc. Likewise, institutions such as prisons and schools use considerable amounts of charcoal in “traditional” devices;
 - b. The first activity would be to do a stock taking of these devices, gauge the extent of their use, and the scope, ease and potential for any interventions;
 - c. While important, these will generally not be as high a priority as household cook stoves, but, that will need to be determined by the MOE and the CESC;
 - d. Interventions should be defined, using best local practice, if available, or best international practice.
 4. **Support for improved stoves:** Following on the results above, particularly Activities 1 and 2 of Component 7, a program for supporting improved cook stoves should be worked out, with a very strong commercial focus, building upon best practice in the ECOWAS Region and internationally, drawing particularly on GIZ’s experience.
 5. **Required time, resources and potential funding sources:** GERES, initial reconnaissance, surveying, interviews, basic testing, 3-4 months. Examining stove producer financing, commercial training, participation with other state-of-the-art producers, to be implemented over a period of 2 years. Testing of existing stoves should take no longer than several months.

GEF incremental values: All these recommendations have been considered under Output 1.3.

Output 8: Support Alternative Energy Sources

- **Objective and outcome:** To reduce the pressure on forestry/woodland resources and to provide safe, economic and affordable alternatives to households, household enterprises and other enterprises that currently use wood fuel and charcoal.
- **Implementation strategy:** The Ministry of Energy and several other agencies, particularly the EPA-SL, are very keen to see LPG more widely used to reduce pressure on Sierra Leone’s forestry resources and to reduce greenhouse gas emissions. The EU, in its support to the EPA-SL identifies charcoal production as one of the major contributors both to deforestation and to greenhouse gas emissions.
- LPG has a long history in Sierra Leone. It was pioneered by British Petroleum in the 1970s and later by Total. It penetrated a good section of the Freetown upper income household cooking market in the 1980s, achieving almost as much of a market share as charcoal (SSL, SIL,2005, Project communications with NP, Total. 2013). With the shutdown of the Freetown refinery and the civil war, LPG almost disappeared.

¹⁹ See Welthungerhilfe, EFO & Wisions. 2013. Report on Freetown Peninsula’s Fishing Smoking Industry. Freetown, 2010. WHH and James Braima, IITA/SLARI on improved garri/cassava processing, report in Bo District, 2013.

- Today, more than a generation of urban households have no experience with LPG. There are major popular concerns about LPG's safety (RRA interviews, Project communication with petroleum distributors, 2013). Until recently, when Total pulled out of the market, distribution networks were limited, as were cylinders.
- Now, Afrigas has joined up with Total to use the latter's distribution network. Afrigas has an aggressive, increasingly popular marketing program. They have undertaken extensive marketing surveys. Their media campaigns are reaching larger audiences. They have imported small cylinders to meet household demand, with standard fixtures.
- LPG's major problem, at the moment, is more about the relative price of charcoal than anything else. The relative price of charcoal, on an end-use basis, is half that of LPG (Total, Afrigas, NP communications, distribution prices, RRA and CDKN/Njala University surveys, 2012). However, its cleanliness, coupled with ease of use and growing distribution market could have a significant impact on upper income urban consumers, particularly were Government to reduce or eliminate import duties for cylinders and fixtures.

As far as other alternatives, such as crop residues and wood wastes, the MOE, through MAFFS and district agriculture and forestry officers, as well as several NGOs and research institutions engaged in alternative energy, can encourage and provide support to them. The UNDP/PREP has financed one crop residue gasifier that is off-grid. It is supporting pilot elephant grass briquetting in Bombali District (Northern Region).

The key will be to find financing support for research and testing these activities. Such work should be done within a strong commercial framework. At present, such a framework is not in place. As an example, the gasifier has been installed for nearly two years and has never supplied one kWh of electricity to any house or business because no grid was built to supply consumers.

The MOE is working with Addax Sugar to test ethanol for cooking. ECREEE has made this one of their priorities to test bio-ethanol gel for cooking in Freetown.

GEF incremental values: These recommendations have been considered under Output 2.6 as part of the phasing out plan of obsolete technology.

ANNEX G: GHG emissions calculations for the switch to improved stoves using UNFCCC Methodology AMS II G version 3 - Energy Efficiency Measures in Thermal Applications of Non Renewable Biomass

This category comprises efficiency improvements in thermal applications of non-renewable biomass. Examples of applicable technologies and measures include the introduction of high efficiency²⁰ biomass fired cook stoves²¹ or ovens or dryers and/or energy efficiency improvements in existing biomass fired cook stoves or ovens or dryers.

1. Emission reductions are calculated as:

$$ER_y = B_{y,savings} \times f_{NRB,y} \times NCV_{biomass} \times EF_{projected_fossilfuel} \times N_{y,i} \quad \text{Equation (1)}$$

Where:

- ER_y = Emission reductions during year y in t CO_{2e}
- $B_{y,savings}$ = Quantity of woody biomass that is saved in tonnes per device
- $f_{NRB,y}$ = Fraction of woody biomass saved by the project activity in year y that can be established as non-renewable biomass using survey methods or government data or default country specific fraction of non-renewable woody biomass (fNRB) values available on the CDM website²²
- $NCV_{biomass}$ = Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/tonne, wet basis)

²⁰ The efficiency of the project systems as certified by a national standards body or an appropriate certifying agent recognized by that body. Alternatively, manufacturers' specifications may be used.

²¹ Single pot or multi pot portable or in-situ cook stoves with specified efficiency of at least 20%.

²² Default values endorsed by designated national authorities and approved by the Board are available at <<http://cdm.unfccc.int/DNA/fNRB/index.html>>.

$EF_{projected\ fossilfuel}$ = Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 t CO₂/TJ²³

$N_{y,i}$ = Number of project devices of type i operating in year y , determined as per paragraph 22

2. $B_{y,savings}$ is estimated using the following methods:

Where:

B_{old} = Quantity of woody biomass used in the absence of the project activity in tonnes per device

$B_{y,new,survey}$ = Annual quantity of woody biomass used during the project activity in tonnes per device, determined through a survey

η_{old} =

1. Efficiency of the device being replaced (fraction); measured using representative sampling methods or based on referenced literature values use weighted average values if more than one type of device is being replaced;
2. A default value of 0.10 may be optionally used if the replaced device is a three stone fire, or a conventional device with no improved combustion air supply or flue gas ventilation, that is without a grate or a chimney; for other types of devices, a default value of 0.2 may be optionally used

$\eta_{new,y}$ = Efficiency of the device being deployed as part of the project activity (fraction), as determined annually¹² using the water boiling test (WBT) protocol carried out in accordance with national standards (if available) or international standards or guidelines.²⁴ Use weighted average values if more than one type of system is being introduced by the project activity

²³ This value represents the emission factor of the substitution fuels likely to be used by similar users, on a weighted average basis. It is assumed that the mix of present and future fuels used would consist of a solid fossil fuel (lowest in the ladder of fuel choices), a liquid fossil fuel (represents a progression over solid fuel in the ladder of fuel use choices) and a gaseous fuel (represents a progression over liquid fuel in the ladder of fuel use choices). Thus a 50% weight is assigned to coal as the alternative solid fossil fuel (96 t CO₂/TJ) and a 25% weight is assigned to both liquid and gaseous fuels (71.5 t CO₂/TJ for kerosene and 63.0 t CO₂/TJ for liquefied petroleum gas (LPG)).

²⁴ In all cases the testing protocol shall be the same for both the device being replaced and the device being deployed.

Based on UNFCCC Meth - AMS II G, Version 2.0

i. Domestic cookstove at 15% annual growth rate

fNRB	90 %	Non renewable biomass
NCV	0.015 TJ/tonne	
EF	71.5 tCO ₂ /TJ	
Cold	10 %	Cookstove efficiency
Cnew	40 %	Cookstove efficiency
A	14,000 unit	Total project units
AFC	11 kg/day	Daily biomass usage
Leakage	0 %	
1-(Cold/Cnew)	0.75	1900

	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	unit	400	3,100	8,100	14,000	16,100	18,515	21,292	24,486	28,159	32,383	37,240	42,826	49,250	56,638
AFC	kg/day/unit	11	11	11	11	11	11	11	11	11	11	11	11	11	11
By	ton/yr	1,606	12,447	32,522	56,210	64,642	74,338	85,488	98,312	113,058	130,017	149,520	171,948	197,740	227,401
By, saving	ton/yr	1,205	9,335	24,391	42,158	48,481	55,753	64,116	73,734	84,794	97,513	112,140	128,961	148,305	170,551
fNRB	fraction	90	90	90	90	90	90	90	90	90	90	90	90	90	90
Leakage	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERy	tCO ₂ e	1,292	10,012	26,159	45,214	51,996	59,795	68,765	79,079	90,941	104,583	120,270	138,310	159,057	182,916
	TCO ₂ e/unit	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2	3.2
	Cum Bsaved	1,205	10,539	34,931	77,088	125,569	181,322	245,439	319,172	403,966	501,479	613,619	742,580	890,885	1,061,435
	Cum ER	1,292	11,303	37,463	82,677	134,673	194,468	263,233	342,312	433,254	537,836	658,106	796,417	955,474	1,138,389

ANNEX H: GHG emissions calculations for institutional and industrial stoves

2. Institutional stove for schools and hospitals

fNRB	100 %	Fraction of Non renewable biomass
NCV	0.015 TJ/tonne	
EF	71.5 tCO ₂ /TJ	
Cold	8 %	Cookstove efficiency
Cnew	45 %	Cookstove efficiency
A	500 unit	
AFC	50 kg/day	Daily biomass usage
Leakage	0 %	

1-(Cold/Cnew) 0.822

	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	unit	20	110	270	600	690	794	913	1,049	1,207	1,388	1,596	1,835	2,111	2,427
AFC	kg/day/unit	50	50	50	50	50	50	50	50	50	50	50	50	50	50
By	ton/yr	365	2,008	4,928	10,950	12,593	14,481	16,654	19,152	22,024	25,328	29,127	33,496	38,521	44,299
By, saving	ton/yr	300	1,651	4,052	9,003	10,354	11,907	13,693	15,747	18,109	20,825	23,949	27,541	31,673	36,424
fNRB	fraction	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Leakage	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERy	tCO ₂ e	322	1,770	4,345	9,656	11,104	12,770	14,686	16,889	19,422	22,335	25,685	29,538	33,969	39,064
	TCO ₂ e/unit	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1	16.1

Based on UNFCCC Meth - AMS II G, Version 2.0

3. Industrial stove for cottage industry - tofu/tempe, salt, bakeries, coffee roasting

fNRB	100 %	Non renewable biomass
NCV	0.015 TJ/tonne	
EF	71.5 tCO ₂ /TJ	
Cold	10 %	Cookstove efficiency
Cnew	50 %	Cookstove efficiency
A	300 unit	
AFC	400 kg/day	Daily biomass usage
Leakage	0 %	

1-(Cold/Cnew) 0.800

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	8	68	196	400	460	529	608	700	805	925	1,064	1,224	1,407	1,618
AFC	400	400	400	400	400	400	400	400	400	400	400	400	400	400
By	1,168	9,928	28,616	58,400	67,160	77,234	88,819	102,142	117,463	135,083	155,345	178,647	205,444	236,261
By, saving	934	7,942	22,893	46,720	53,728	61,787	71,055	81,714	93,971	108,066	124,276	142,918	164,355	189,008
fNRB	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Leakage	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ERy	1,002	8,518	24,553	50,107	57,623	66,267	76,207	87,638	100,783	115,901	133,286	153,279	176,271	202,712
TCO ₂ e/unit	125.3	125.3	125.3	125.3	125.3	125.3	125.3	125.3	125.3	125.3	125.3	125.3	125.3	125.3

ANNEX I: GHG emissions calculations for efficient charcoal kilns

AMS-III.BG: Emission reduction through sustainable charcoal production and consumption Version 02.0

(http://cdm.unfccc.int/filestorage/y/r/EDIG2RQ0V3THB89SKCNLAXUZ1J6WF5.pdf/eb73_repan11.pdf?t=M3V8bjFzMGxsfDDsiKoYSSK73aZkf-QyqRZJ)

Project activity shall introduce efficient charcoal production technologies using renewable biomass feedstock such as biomass residues to displace the production of charcoal in unimproved traditional kilns by the informal sector thereby leading to emission reductions. Charcoal production facility may include briquetting facility for the agglomeration of smaller biomass particles. Methane produced during charcoaling process is either: (a) captured and destructed or gainfully used for heat or electricity; or (b) not captured and not destructed. Examples of these technologies include but are not limited to:

- (a) Retort Sedentary kilns (e.g. Adam retort) which capture the pyrolysis gas; captured gas may be gainfully used for example as a fuel for pre-heating the facility or for wood drying or for production of heat and/or power;
- (b) Improved sedentary kilns without the capture of pyrolysis gas;
- (c) Casamance kilns.

Baseline scenario

- . For the charcoal portion produced from non-renewable biomass in the baseline, it is assumed that in the absence of the project activity, the baseline scenario would be the future use of fossil fuels for meeting similar thermal energy needs.
- . For the charcoal portion produced from renewable biomass in the baseline, traditional open-ended methods resulting in methane emitted to the atmosphere forms the baseline scenario.

5.3. Emission reductions

19. For the project technology equipped with capture and destruction of the pyrolysis gases emission reductions are calculated as follows:

$$ER_y = \sum_i Q_{CCP,i,y} \times [(f_{NRB,BL,wood} \times NCV_{charcoal,i} \times EF_{projected_fossilfuel}) + (SMG_{y,b} - M_d) \times (1 - f_{NRB,BL,wood}) \times GWP_{CH_4,y}] - PE_{y,fugitive} - PE_{y,flaring} - PE_{FF,y} - PE_{EL,y}$$

Equation (1)

Where:

- ER_y = Emission reductions in year y^A (t CO₂e/yr)
- $Q_{CCP,i,y}$ = Quantity of charcoal type i produced and used in year y (t)
- $f_{NRB,BL,wood}$ = Fraction of biomass of type i used in the absence of the project activity that can be established as non-renewable biomass; determined as per the procedure found in the latest version of "AMS-I.E: Switch from non-renewable biomass for thermal applications by the user" or on the basis of the published DNA endorsed default values available on the UNFCCC website⁵
- $NCV_{charcoal,i}$ = Net calorific value of the charcoal type i produced during the project (TJ/t). This shall be determined using one of the options provided in appendix 1
- $EF_{projected_fossilfuel}$ = Emission factor for the substitution of non-renewable woody biomass by similar consumers. Use a value of 81.6 t CO₂/TJ
- $GWP_{CH_4,y}$ = Global warming potential of methane applicable to the crediting period (t CO₂e/t CH₄)

- $SMG_{y,b}$ = Specific methane generation for the baseline charcoal generation process in the year y (tonnes CH_4 /t charcoal product); a default value of 0.030 t CH_4 /t charcoal may be used. Alternatively, the value can be determined in accordance with the procedure provided in the latest version of "AMS-III.K: Avoidance of methane release from charcoal production"
- M_d = Factor to account for any legal requirement for capture and destruction of methane in the charcoal production facility (tonne of CH_4 /tonne of raw material)
- $PE_{y,flaring}$ = If applicable, emissions due to the flare inefficiency in the project charcoal manufacturing plant in the year y (t CO_2e) determined in accordance with the procedure provided in AMS-III.K. In case captured pyrolysis gas is gainfully used (e.g. as fuel for pre-heating the facility, or for wood drying, or used for production of heat and/or power), then it can be taken as zero
- $PE_{FF,y}$ = Project emissions due to fossil fuel consumption in charcoal production facilities in year y (t CO_2)
- $PE_{EI,y}$ = Project emissions due to electricity consumption in charcoal production facilities in year y (t CO_2)

Where:

- $PE_{y,fugitive}$ = Fugitive emissions from operation of charcoal producing facility (physical leakage) in the year y (t CO_2e)
- f = A fraction attributed to project charcoal production technology, use a default value of 0.1.

For the project activity not equipped with capture and destruction of the pyrolysis gases, emission reductions are calculated as follows:

$$ER_y = \sum_1 Q_{CCP,y} \times \left(f_{NRBLwood} \times NCV_{charcoal} \times EF_{projected_fossilfuel} \right) - PE_{FF,y} - PE_{EI,y} \quad \text{Equation (3)}$$

For determination of net calorific value of charcoal:

1. NCV of charcoal may differ from the standard IPCC value for charcoal due to: (i) operating parameters of the carbonization process; as well as (ii) the types of inputs (types and quality of biomass).

2. $NCV_{charcoal,i}$ can be determined according to the following Options 1 to 2.

1. **Option 1: deemed value**

3. For the charcoal from coconut husks, bamboo and other purely woody source of biomass, the following assumption can be made:

$$NCV_{charcoal,i} = 0.0295 GJ/tonne$$

$$NCV_{charcoal,i} = 29.5 GJ/tonne$$

Equation (1)

(Value assumed: from IPCC 2006, Volume 2, Table 1.2)

4. For other charcoal sources such as mixed agricultural wastes, the following minimum default value can be used:

$$NCV_{charcoal,i} = 0.66 \times 0.0295 GJ/tonne = 0.01947 GJ/tonne$$

$$NCV_{charcoal,i} = 0.66 \times 29.5 GJ/tonne = 19.47 GJ/tonne$$

Equation (2)

2. **Option 2: determination of $NCV_{charcoal,i}$ based on the three feedstock sizes**

5. In accordance with the correlation developed by Parikh et al. (2005) as found in Misginna et al., the net calorific value of charcoal produced can be determined based on the following equation:

$$NCV_{charcoal,i} = 0.3536 \times CC_{i,P,Y} + 0.1559 \times VM_{i,P,Y} - 0.0078 \times$$

$ASH_{i,P,Y}$

Equation (3)

Where:

$NCV_{charcoal,i}$ = Net calorific value of charcoal i produced (TJ/t)

$CC_{i,P,Y}$ = Carbon content in the charcoal product from the biomass type i , in year y (kg carbon/kg charcoal product)

$VM_{i,P,Y}$ = Share of volatile matter in the charcoal product from the biomass type i , in year y (kg volatile matter/kg charcoal product)

$ASH_{i,P,Y}$ = Ash content in the charcoal product from the biomass type i , in year y (kg ash/kg charcoal product)

SUSTAINABLE CHARCOAL PRODUCTION

Type of Charcoal Kilns	Number of Units Installed	Annual Production, tons	Useful Life, Years	Total Lifetime Production (t)	No. of Replacements
Traditional Kiln	1	7	1	7	4
Adams Retort	1	24	1	24	0
Casamance Kiln	0	9.6	1	0	2

NOTES:	Charcoal to Wood Ratio	Useful Life, years	Annual Fuelwood used (t) to produce 24t charcoal	Annual fuelwood savings (t)	Annual Methane avoided (t)
Traditional Kilns	0.208	3	115.4	53.0	4
Adams Retort	0.385	10	62.3	?	?
Casamance Kiln	0.25	5			

Assumptions:

Traditional Kilns have a minimum charcoal yield of 250kg from about 1,200kg wood.
 Adams Retorts have an average yield of 250kg of charcoal from 650kg of wood (dry basis)
 Casamance Kilns have an average yield of 200kg of charcoal from 800kg of wood (dry basis)
 Average annual production from Adams Retorts is 24 tons of charcoal; for Casamance it is 9.6 tons of charcoal
 Optimized charcoal production from use of Adams Retorts can entirely avoid the emissions of CH4 from pyrolytic gases resulting from traditional processes. Avoiding CH4 emissions through such technology represents an emission reduction of roughly 3.5t CO2e per ton of charcoal produced.
 Based on data from a leading study, with a conservative estimate of the percentage carbon content in wood, the CO2 reduction conversion factor savings from avoiding the use of non-renewable biomass represents an emission reduction of roughly 3.7t CO2e per ton of charcoal produced (Bailis, Modeling Climate Change mitigation from alternative methods of charcoal production in Kenya, 2009).
 Total losses (i.e., production facility, charcoal transport, and distribution to consumers) do not exceed 5 percent.

Annual direct project and End of Project Emissions reductions

GHG emission baseline / kiln 173 [tCO₂eq/kiln/yr]
 GHG emission project+leakage / 8.64 [tCO₂eq/kiln/yr]

Year	Kiln intallation		Greenhouse gas emissions			
	End of year [# of kiln]	Cummulative [# of kiln]	Baseline End of year [tCO ₂ eq/yr]	Project End of year [tCO ₂ eq/yr]	Reduction End of year [tCO ₂ eq/yr] Cummulative [tCO ₂ eq]	
1	20	20	3,456	173	3,283	3,283
2	150	170	29,376	1,469	27,907	31,190
3	320	490	84,672	4,234	80,438	111,629
4	510	1,000	172,800	8,640	164,160	275,789
5	-	1,000	172,800	8,640	164,160	439,949
6		1,000	172,800	8,640	164,160	604,109
7		1,000	172,800	8,640	164,160	768,269
8		1,000	172,800	8,640	164,160	932,429
9		1,000	172,800	8,640	164,160	1,096,589
10		1,000	172,800	8,640	164,160	1,260,749
11	(20)	980	169,344	8,467	160,877	1,421,626
12	(150)	830	143,424	7,171	136,253	1,557,878
13	(320)	510	88,128	4,406	83,722	1,641,600
14	(510)	-	-	-	-	1,641,600
			1,728,000	86,400	1,641,600	

Average
68,947

F. Project Indirect Emissions reductions at 5% annual growth rate

Year	Fuel Wood saving (t/yr)	Cumulative	Kiln growth (10%)	Annual GHG reduction (tCO ₂ e/yr)	Cumulative GHG reduction (tCO ₂ e/yr)	Methane avoided (t/pl/yr)	Cumulative
1	1,060.94					80	
2	7,957.04					600	
3	16,975.02					1,280	
4	27,053.95	27,054	1,000	275,789	275,789	2,040	
5	28,407	55,461	1,050	289,578	565,367	2,142	4,182
6	29,827	85,288	1,103	304,057	869,424	2,249	4,391
7	31,318	116,606	1,158	319,260	1,188,684	2,362	4,611
8	32,884	149,490	1,216	335,223	1,523,907	2,480	4,841
9	34,528	184,019	1,276	351,984	1,875,891	2,604	5,083
10	36,255	220,273	1,340	369,583	2,245,475	2,734	5,337
11	38,068	258,341	1,407	388,063	2,633,537	2,870	5,604
12	39,971	298,312	1,477	407,466	3,041,003	3,014	5,884
13	41,970	340,282	1,551	427,839	3,468,842	3,165	6,179
14	44,068	384,350	1,629	449,231	3,918,073	3,323	6,488
15	46,271	430,621	1,710	471,692	4,389,765	3,489	6,812