



GLOBAL ENVIRONMENT FACILITY  
INVESTING IN OUR PLANET

**Naoko Ishii**  
CEO and Chairperson

May 1, 2017

Dear Council Member,

The AfDB as the Implementing Agency for the project entitled: *Liberia: Increasing Energy Access through the Promotion of Energy Efficient Appliances in Liberia*, has submitted the attached proposed project document for CEO endorsement prior to final Agency approval of the project document in accordance with the AfDB procedures.

The Secretariat has reviewed the project document. It is consistent with the project concept approved by the Council in October 2015 and the proposed project remains consistent with the Instrument and GEF policies and procedures. The attached explanation prepared by the AfDB satisfactorily details how Council's comments and those of the STAP have been addressed.

We have today posted the proposed project document on the GEF website at [www.TheGEF.org](http://www.TheGEF.org) for your information. We would welcome any comments you may wish to provide by May 30, 2017 before I endorse the project. You may send your comments to [gcoordination@TheGEF.org](mailto:gcoordination@TheGEF.org).

If you do not have access to the Web, you may request the local field office of UNDP or the World Bank to download the document for you. Alternatively, you may request a copy of the document from the Secretariat. If you make such a request, please confirm for us your current mailing address.

Sincerely,

Naoko Ishii  
Chief Executive Officer and Chairperson

Attachment: GEFSEC Project Review Document  
Copy to: Country Operational Focal Point, GEF Agencies, STAP, Trustee



# GEF-6 REQUEST FOR PROJECT ENDORSEMENT/APPROVAL

PROJECT TYPE: FULL-SIZED PROJECT

TYPE OF TRUST FUND: GEF TRUST FUND

For more information about GEF, visit [TheGEF.org](http://TheGEF.org)

## PART I: PROJECT INFORMATION

Project Title: Increasing energy access through the promotion of energy efficient appliances in Liberia			
Country(ies):	Liberia	GEF Project ID: <sup>1</sup>	9292
GEF Agency(ies):	AfDB	GEF Agency Project ID:	
Other Executing Partner(s):	Ministry of Lands, Mines and Energy	Submission Date:	01.03.2017
GEF Focal Area (s):	Climate Change	Project Duration (Months)	36 months
Integrated Approach Pilot	IAP-Cities <input type="checkbox"/> IAP-Commodities <input type="checkbox"/> IAP-Food Security <input type="checkbox"/>		Corporate Program: SGP <input type="checkbox"/>
Name of Parent Program	Not applicable	Agency Fee (\$)	250,774

### A. FOCAL AREA STRATEGY FRAMEWORK AND OTHER PROGRAM STRATEGIES<sup>2</sup>

Focal Area Objectives /Programs	Focal Area Outcomes	Trust Fund	(in \$)	
			GEF Project Financing	Co-financing
CCM-1 Program 1	Promote timely development, demonstration and financing of low-carbon technologies and mitigation options	GEFTF	2,639,726	40,100,000
<b>Total project costs</b>			2,639,726	40,100,000

### B. PROJECT DESCRIPTION SUMMARY

Project Objective: To increase access to electricity in rural Liberia while promoting and mainstreaming the use of energy efficiency measures						
Project Components/ Programs	Financing Type <sup>3</sup>	Project Outcomes	Project Outputs	Trust Fund	(in \$)	
					GEF Project Financing	Confirmed Co-financing
<b>Component 1:</b> Institutional support and capacity building to promote energy efficiency	TA	1) Policy, planning and regulatory frameworks foster accelerated low GHG development and emissions mitigation through the promotion of energy efficiency measures 2) Financial mechanisms to	1.1. Capacity building through trainings (#10) provided to key stakeholders (including MLME, MOCI, MOFD, LEC, RREA, NCCS/EPA etc.) on drafting and implementing policy and regulatory	GEFTF	220,000	6,948,000

<sup>1</sup> Project ID number remains the same as the assigned PIF number.

<sup>2</sup> When completing Table A, refer to the excerpts on [GEF 6 Results Frameworks for GETF, LDCF and SCCE](#).

<sup>3</sup> Financing type can be either investment or technical assistance.

		support GHG reductions are demonstrated and operationalized	frameworks for promotion of energy efficient appliances in Liberia to approach climate change mitigation.		
	TA		1.2. Baseline data on energy consumption, electricity access, its distribution, electrical energy usage pattern, GHG emission etc. collected and documented.		180,000
	TA		1.3. Feasibility reports (#4) to expand energy efficiency infrastructure across sectors prepared. Target areas identified and action plans developed for implementing energy efficiency policies (as a part of a comprehensive Low Carbon Development Roadmap).		170,000
	TA		1.4. Incentive mechanisms (including non-subsidy) to encourage the uptake and mainstreaming of energy efficient appliances in project areas identified and developed (as a part of Comprehensive Sustainable Rural Electrification Framework Plan).		50,000
	TA		1.5. Policy and legislations for the gradual phase out of		80,000

			incandescent lamps identified and formulated, regulatory measures identified.			
<b>Component 1 total TA</b>					<b>700,000</b>	<b>6,948,000</b>
<b>Component 1 total Inv.</b>					<b>0</b>	
Component 2: Energy efficient lighting and public outreach pilot program	TA	1) Accelerated adoption of innovative technologies and management practices for GHG emission reduction and carbon sequestration	2.1. Technical support provided for intensification and identification of subsidy schemes which integrate energy efficiency.	GEFTF	39,025	30,880,000
	TA		2.2. Pilot program preparation and pre-execution activities completed. Working model and distribution strategy (including timelines) of the pilot program finalized among key stakeholders.		-	
	TA	2) Energy efficiency infrastructure put in place in target areas	2.3. Standards and specifications for LED technology tenders developed		10,000	
	TA		2.4. Public outreach programs on energy efficiency and climate change in project areas conducted		75,000	
	TA		2.5. Pilot program involving distribution of LED bulbs (#80,000) at 40,000 households (connections) across project areas conducted. Capacity building training sessions organised for pilot project team for smooth execution of the program		50,000	
	Inv.				1,140,000	
TA		2.6. Recycling	35,000			

			program for used lighting organized and initiated			
	TA		2.7. Quality control protocols established and measures initiated. Reductions in energy consumption and GHG emission attributable to pilot program monitored, measured and reported. Results and experience of pilot program documented		245,000	
	TA		2.8. Growth strategy drafted, based on experience and learnings from pilot program, for expansion of program in future		45,000	
	TA		2.9. Needs assessment workshop on energy efficient products and appliances conducted in project areas for developing future strategies		25,000	
	<b>Component 2 total TA</b>				<b>524,025</b>	<b>30,880,000</b>
	<b>Component 2 total Inv</b>				<b>1,140,000</b>	
Component 3: Knowledge Management and Monitoring and evaluation	TA	1) Impacts of project as whole will be assessed, key challenges identified, and mitigation measures proposed.	3.1. Monitoring and evaluation work plan formulated and implemented,	GEFTF	100,000	772,000
	TA		3.2. Lessons learned from the EE project documented and knowledge disseminated on online platform to enable replication of pilot program		35,000	
	TA	2) Final project documentation prepared and made available online.	3.3. Coordination with the implementation of LEAP		15,000	

			strengthened through knowledge sharing and management			
<b>Component 3 total TA</b>					<b>150,000</b>	<b>772,000</b>
<b>Component 3 total Inv.</b>					0	
				Subtotal	2,514,025	38,600,000
				Project Management Cost (PMC) <sup>4</sup>	GEFTF 125,701	1,500,000
				<b>Total project costs</b>	2,639,726	40,100,000

**C. CONFIRMED SOURCES OF CO-FINANCING FOR THE PROJECT BY NAME AND BY TYPE**

Please include evidence for co-financing for the project with this form.

Sources of Co-financing	Name of Co-financier	Type of Cofinancing	Amount (\$)
GEF Agency	AfDB	Loans	19,300,000 <sup>5</sup>
Donor Agency	European Union Africa Infrastructure Trust Fund	Grants	10,800,000 <sup>6</sup>
GEF Agency	Nigerian Trust Fund	Loans	10,000,000
<b>Total Co-financing</b>			40,100,000

**D. TRUST FUND RESOURCES REQUESTED BY AGENCY(IES), COUNTRY(IES) AND THE PROGRAMMING OF FUNDS**

GEF Agency	Trust Fund	Country Name/Global	Focal Area	Programming of Funds	(in \$)		
					GEF Project Financing (a)	Agency Fee <sup>a)</sup> (b) <sup>2</sup>	Total (c)=a+b
AfDB	GEF TF	Liberia	Climate Change		2,639,726	250,774	2,890,500
<b>Total Grant Resources</b>					2,639,726	250,774	2,890,500

a) Refer to the Fee Policy for GEF Partner Agencies

**E. PROJECT'S TARGET CONTRIBUTIONS TO GLOBAL ENVIRONMENTAL BENEFITS<sup>7</sup>**

Provide the expected project targets as appropriate.

<sup>4</sup> For GEF Project Financing up to \$2 million, PMC could be up to 10% of the subtotal; above \$2 million, PMC could be up to 5% of the subtotal. PMC should be charged proportionately to focal areas based on focal area project financing amount in Table D below.

<sup>5</sup> The AfDB co-financing is denominated in Unit of Account (UA). As of end January 2017, UA1 = \$1,417,034

<sup>6</sup> The EU grant is for a total amount of Euro 10,000,000. As of end January 2017, Euro 1 = 1,08

<sup>7</sup> Update the applicable indicators provided at PIF stage. Progress in programming against these targets for the projects per the *Corporate Results Framework* in the GEF-6 Programming Directions, will be aggregated and reported during mid-term and at the conclusion of the replenishment period.

Corporate Results	Replenishment Targets	Project Targets
1. Maintain globally significant biodiversity and the ecosystem goods and services that it provides to society	Improved management of landscapes and seascapes covering 300 million hectares	NA
2. Sustainable land management in production systems (agriculture, rangelands, and forest landscapes)	120 million hectares under sustainable land management	NA
3. Promotion of collective management of transboundary water systems and implementation of the full range of policy, legal, and institutional reforms and investments contributing to sustainable use and maintenance of ecosystem services	Water-food-ecosystems security and conjunctive management of surface and groundwater in at least 10 freshwater basins;	NA
	20% of globally over-exploited fisheries (by volume) moved to more sustainable levels	NA
4. Support to transformational shifts towards a low-emission and resilient development path	750 million tons of CO <sub>2e</sub> mitigated (include both direct and indirect)	173,838 tons of CO <sub>2</sub>
5. Increase in phase-out, disposal and reduction of releases of POPs, ODS, mercury and other chemicals of global concern	Disposal of 80,000 tons of POPs (PCB, obsolete pesticides)	NA
	Reduction of 1000 tons of Mercury	NA
	Phase-out of 303.44 tons of ODP (HCFC)	NA
6. Enhance capacity of countries to implement MEAs (multilateral environmental agreements) and mainstream into national and sub-national policy, planning financial and legal frameworks	Development and sectoral planning frameworks integrate measurable targets drawn from the MEAs in at least 10 countries	NA
	Functional environmental information systems are established to support decision-making in at least 10 countries	NA

**F. DOES THE PROJECT INCLUDE A “NON-GRANT” INSTRUMENT? No**

(If non-grant instruments are used, provide an indicative calendar of expected reflows to your Agency and to the GEF/LDCF/SCCF Trust Fund) in Annex D.

**Not applicable**

## **PART II: PROJECT JUSTIFICATION**

### **A. DESCRIBE ANY CHANGES IN ALIGNMENT WITH THE PROJECT DESIGN WITH THE ORIGINAL PIF<sup>8</sup>**

No significant changes have been made in the project design as compared to the original PIF. However, the locations at which the pilot distribution program under component 2 will be conducted have changed from the PIF stage owing to alignment with the baseline project – LEAP. The pilot program will now be conducted across the Monrovia – RIA corridor and the Pleebo – Fish Town corridor. The locations are marked by the red-coloured lines in the following map.



Also, a number of changes in the outputs of the project have been made to clarify the output wording and to facilitate quantifying of results and support in effective M&E activities. The following tables summarise the changes made following PPG consultations in terms of the formulation of project’s outcomes/outputs and co-financing activities:

The project outputs have been contextualized to fit the current needs in Liberia, following the consultations held during the PPG phase.

The following table details the revisions to outputs under Component 1.

<b>Output as written in the PIF</b>	<b>Output revised after PPG consultations</b>	<b>Justification</b>
1.1. Trainings (#30, #20 staffs per session) provided to relevant ministries to plan, enforce and review energy efficiency measures and approach climate change mitigation	1.1. Capacity building through trainings (#10) provided to key stakeholders (including MLME, MOCI, MOFD, LEC, RREA, NCCS/EPA etc.) on drafting and implementing policy and regulatory frameworks for	This output was merged with Output 1.2, which focusses on strengthening technical and institutional capacity of policymakers to draft and implement energy efficiency policies in Liberia.

<sup>8</sup> For questions A.1 –A.7 in Part II, if there are no changes since PIF , no need to respond, please enter “NA” after the respective question.



	<p>promotion of energy efficient appliances in Liberia to approach climate change mitigation</p>	<p>Also, the total number of trainings proposed is 10 with 20 participants in each training, instead of 30 considered at PIF stage. The number of training programs have been reduced because each of the proposed trainings have been considered as a full day session and based on the initial discussions with stakeholders it was observed that ten nos. of training program would be sufficient.</p> <p>However, this number shall be reassessed during implementation phase. In any case, the budget for the trainings component remains unchanged as this has been kept liberal.</p>
<p>1.2. Trainings (#10) and support provided to the National Climate Change Secretariat (NCCS) for identifying the impacts of energy efficiency on climate change and support for formulating comprehensive low carbon development roadmap</p>		<p>This former part of this output has been incorporated as the initial activity in Output 1.1 as it is seen as a part of the capacity building and training agenda.</p> <p>The latter part of this output, i.e. support for formulating a comprehensive low carbon development roadmap has been included in output 1.3</p>
<p>-</p>	<p>1.2. Baseline data on energy consumption, electricity access, its distribution, electrical energy usage pattern, GHG emission etc. collected and documented</p>	<p>Data collection is an integral component of all the successive outputs, and therefore has been projected separately to avoid repetition of this activity.</p>
<p>1.3. Policy and legislations (#2) for the gradual phase out of incandescent lamps identified and formulated, regulatory measures identified.</p>	<p>1.3 Feasibility reports (#4) to expand energy efficiency infrastructure across sectors prepared. Target areas identified and action plans developed for implementing energy efficiency policies (as a part of a comprehensive Low Carbon Development Roadmap</p>	<p>This output has been shifted to output 1.5 to maintain chronological order of the outputs. The output has been reworded to bring out more clarity.</p> <p>Also, the number of policies and legislations is difficult to specify at this stage given the term's broad scope. Therefore, the number has</p>

	1.4 Incentive mechanisms (including non-subsidy) to encourage the uptake and mainstreaming of energy efficient appliances in urban and rural areas identified and developed (as a part of a comprehensive Sustainable Rural Electrification Framework Plan).	been left out, and shall be determined during project implementation.
1.4. Incentive mechanisms (#3, including non-subsidy) to encourage the uptake and mainstreaming of energy efficient appliances in rural areas identified and developed for the creation of a comprehensive Sustainable Rural Electrification Framework Plan	1.5 Policy and legislations for the gradual phase out of incandescent lamps identified and formulated, regulatory measures identified	This output has been reworded to highlight that the key deliverables under this project are only the incentive mechanisms, and not development of comprehensive Sustainable Rural Electrification Framework Plan.  Also, the number of mechanisms has been left out, because of the broad nature of the scope of the term “incentive mechanism”.  This will be identified during project implementation.
1.5. Feasibility reports (#4) and action plans to expand energy efficiency infrastructure in targeted areas produced		This output has been shifted to output 1.3 to maintain chronological order of the outputs.  Also, the latter part of output 1.2 at the PIF stage, i.e. preparation of comprehensive Low Carbon Development Roadmap, has been included in this output.  Collection of baseline data is a key component in development of feasibility reports and policies and has been included as a separate output. However, the budget for this component remains the same.

The following table details the revisions made to outputs under Component 2. Under this component, the outputs have been re-ordered and reworded in accordance with the results of the PPG stakeholder consultations.

<b>Output as written in the PIF</b>	<b>Output revised after PPG consultations</b>	<b>Justification</b>
2.1 Technical support for intensification and identification of subsidy schemes which	2.1. Conducted energy efficiency assessment of LEC network and provided technical support	The output 2.2 has been combined with 2.1 as the data collected activity is common for both

integrate energy efficiency	for intensification and identification of subsidy schemes which integrate energy efficiency.	outputs.
2.2 Energy efficiency audit of LEC rural distribution network	Included in output 2.1	This output requires collection of data and identification of potential areas for improving energy efficiency in rural areas.  This has been included in output 2.1 of component 2.
2.3 Action plans for EE promotion program in targeted areas formulated	Included in output 1.3	Output 1.3 of component 1 includes development of feasibility reports and action plans for enhancing energy efficiency across the country, including target areas mentioned in this output. Therefore, the output is included in output 1.3 of component 1.
2.4 Pilot programs demonstrating subsidized energy saving lighting through LEC network in rural areas for households and public spaces	2.2. Pilot program preparation and pre-execution activities completed. Effective coordination with the LEAP project established. Working model and distribution strategy (including timelines) of the pilot program finalized among key stakeholders.	This output has been merged with output 2.8 of the PIF and has been included as output 2.2.
2.5 Recycling program for used lighting organized and initiated		This output has been moved to output 2.6 to maintain chronological order of the outputs
2.6 Financial mechanisms for pilot distribution identified	2.3. Standards and specifications for LED technology tenders developed	This output has been included in output 2.1 to maintain chronological order.
2.7 Baseline methodology for collecting GHG emission data in project areas established	2.4. Public outreach programs on energy efficiency and climate change in project areas conducted. Pilot programs demonstrating subsidized energy saving lighting through LEC network in urban and areas for households and public spaces.	Baseline methodology for collecting GHG emission data needs to be established during M&V of the pilot program. Due to this, the output has been merged with output 2.7.
2.8 Public outreach program on energy efficiency and climate change in 3 counties initiated	2.5. Pilot program involving distribution of LED bulbs (#80,000) at 40,000 households (connections) across project areas conducted	This output has been merged with output 2.4 of the PIF and has been included as output 2.2. This is because both these outputs will result in increased public awareness about the pilot program and energy efficiency, and will be conducted at the start of the pilot

	<p>2.6. Recycling program for used lighting organized and initiated</p> <p>2.7. Quality control protocols established and measures initiated. Reductions in energy consumption and GHG emission attributable to pilot program monitored, measured and reported. Results and experience of pilot program documented.</p> <p>2.8. Growth strategy drafted, based on experience and learnings from pilot program, for expansion of program in future</p> <p>2.9. Needs assessment workshop on energy efficient products and appliances conducted in project areas</p>	<p>program.</p> <p>Also, the term “3 counties” have been replaced with “project locations” so that it is in line with the project scope</p>
<p>2.9 Needs assessment workshop on energy efficient products and appliances conducted in 3 counties</p>		<p>This output has been included as output 2.9. However, the term “3 counties” has been replaced with “project areas”</p>

The following table details the revisions to outputs under Component 3. Following stakeholder consultation, the four outputs have been restructured, however, they remain focussed on similar deliverables.

<b>Output as written in the PIF</b>	<b>Output revised after PPG consultations</b>
<p>3.1. Coordination with the implementation of LEAP strengthened through knowledge sharing and management</p>	<p>3.1 Monitoring and evaluation work plan formulated and implemented, detailed M&amp;E documentation produced</p>
<p>3.2. Detailed M&amp;E documentation produced</p>	
<p>3.3. Knowledge on energy efficiency, renewable energy and climate change disseminated through dedicated online platform</p>	<p>3.2 Lessons learned from the GEF financed project documented and knowledge disseminated on online platform to aid replication</p>
<p>3.4. Monitoring and evaluation work plan formulated and implemented, M&amp;E documentation produced</p>	<p>3.3 Coordination with the implementation of LEAP strengthened through knowledge sharing and management</p>

Alongwith the above changes, the outcomes of Component 3 have been reworded and restructured for improving their clarity. The changes are mentioned below:

<b>Component</b>	<b>Outcome as written in the PIF</b>	<b>Outcome revised after PPG consultations</b>	<b>Justification</b>
Component 1	<p>Policy, planning and regulatory frameworks foster accelerated low GHG development and emissions mitigation through the promotion of energy efficiency measures</p> <p>Financial mechanisms to support GHG reductions are demonstrated and operationalized</p>	<p>1) Policy, planning and regulatory frameworks foster accelerated low GHG development and emissions mitigation through the promotion of energy efficiency measures</p> <p>2) Financial mechanisms to support GHG reductions are demonstrated and operationalized</p>	No changes
Component 2	<p>Accelerated adoption of innovative technologies and management practices for GHG emission reduction and carbon sequestration energy efficiency infrastructure put in place in target areas Increased public awareness and acceptance of energy efficiency and climate change</p>	<p>1) Accelerated adoption of innovative technologies and management practices for GHG emission reduction and carbon sequestration</p> <p>2) Energy efficiency infrastructure put in place in target areas</p> <p>3) Increased public awareness and acceptance of energy efficiency and climate change</p>	No changes
Component 3	<p>Project results and lessons learned, captured and disseminated</p> <p>Knowledge captured and shared with stakeholders to strengthen coordination and national knowledge base</p>	<p>1) Impacts of project as whole will be assessed, key challenges identified, and mitigation measures proposed.</p> <p>2) Final project documentation prepared and made available online.</p>	<p>The positions of the outcomes have been interchanges to maintain chronological order.</p> <p>The wordings of the outcomes have been modified to avoid ambiguities.</p>

All abbreviations are listed in **Annex E**.

## **A.1. PROJECT DESCRIPTION:**

Elaborate on: 1) the global environmental and/or adaptation problems, root causes and barriers that need to be addressed; 2) the baseline scenario or any associated baseline projects, 3) the proposed alternative scenario, GEF focal area strategies, with a brief description of expected outcomes and components of the project, 4) [incremental/additional cost reasoning](#) and expected contributions from the baseline, the GEFTF, LDCF, SCCF, and [co-financing](#); 5) [global environmental benefits](#) (GEFTF) and/or [adaptation benefits](#) (LDCF/SCCF); and 6) innovativeness, sustainability and potential for scaling up.

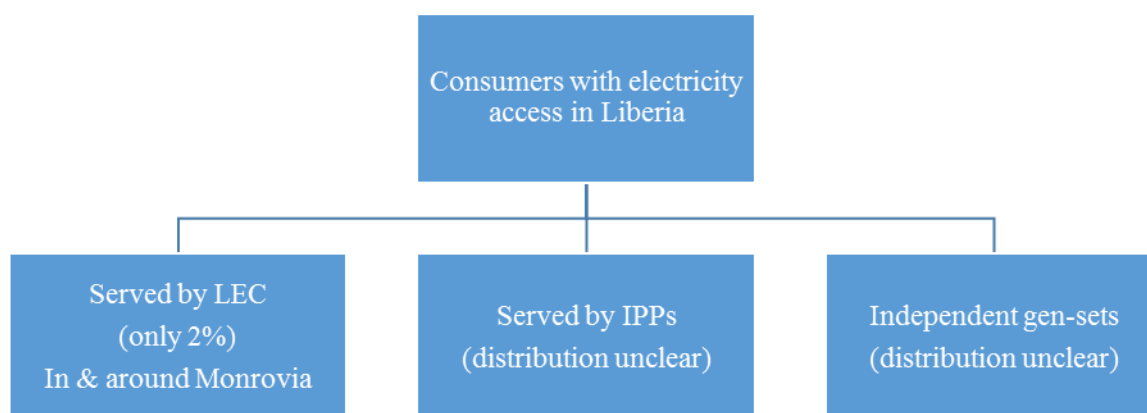
*1) Global environmental and/or adaptation problems, root causes and barriers that need to be addressed:*

### **Energy sector in Liberia**

The energy sector in Liberia is in a crisis as a consequence of a 14-year long civil war that nearly crippled the entire electricity grid and road infrastructure across the country. The subsequent looting that took place in 2005 caused the decommissioning of the Mt. Coffee Hydro Power Plant and caused further damaged the remaining infrastructure in the country. Since then, the country has made commendable strides in reconstructing the damaged infrastructure and reverse the damage caused by the war.

The only public electricity utility, the Liberia Electricity Corporation (LEC), *which is responsible for generation, transmission and distribution of electricity*, restarted operations in 2008 and currently serves 40,000 customers, which include residential households, commercial and government consumers. However, the LEC network is limited to areas in and around Monrovia. Consumers not connected to the LEC are served by Independent Power Producers (IPPs) or independent *diesel-run* generator sets or remain unconnected. Even in Monrovia, large energy consumers such as hotels use diesel-run generator sets to supply their energy needs because of unreliability of the electricity grid.

The rate of access to electricity<sup>9</sup> in Liberia is approximately 10%, considerably lower than the sub-Saharan African average of 28.5% and one of the lowest in the world. The rate of access to public electricity is around 2%, which is mostly concentrated in or around the national capital, Monrovia. According to government data, nearly 10% of urban and fewer than 2% rural inhabitants across the country have access to electricity. **At present, data on access to electricity outside Monrovia and GHG emissions is unavailable.** The following diagram summarizes the existing situation regarding consumers' access to electricity in Liberia.



<sup>9</sup> The population with access to electricity includes not only those connected to the national grid, but also those who derive their electricity supply from other sources such as diesel generators and Independent Power Producers (IPPs)

The figure illustrates the fact that Liberia has one of the lowest electricity access rates in the world. However, post-civil crises the country is progressively working for increase in consumers' access to electricity. Presently, the LEC operates following electricity generation units:

1. Bushrod Island – 15 MW (15 engines of 1 MW each, runs in diesel fuel)
2. Kru Town – 5 MW (5 engines of 1 MW each, runs in diesel fuel)
3. Congo Town – 2 MW (2 engines of 1 MW each, runs in diesel fuel)
4. Mount Coffee Hydro Power Plant – Recently recommissioned in December 2016 and is expected to add up to 88 MW of generation capacity to the LEC
5. Firestone Hydroelectric Power Station - Capacity of generating 4.8 MW

Amongst the above, 15 nos. of 1 MW units are operating round the clock.

The LEC distribution network is limited to areas in and around Monrovia, and is virtually non-existent elsewhere in the country. There are several ongoing projects to repair the distribution network in the country, but are mainly focused in the Greater Monrovia region.

Given the present situation and apparent lack of public electricity in most regions of the country, it is vastly inadequate to meet the energy requirements of the people. In March 2012 LEC served about 5,600 connections in Monrovia (around 2,500 residents from an estimated number of 210,000 households). In August 2012, the number of customers served by LEC increased to 11,000. This number reached 40,000 by December 2016.

Although the numbers are increasing, most households in rural areas and those urban areas outside Monrovia derive their electricity requirements through Independent Power Producers (IPPs) and independent diesel run generators. The exact numbers and distribution is unclear, as the sector is completely unregulated. The remaining population of Liberia rely primarily on charcoal and firewood for their energy needs. Based on the 2008 Census Data, it is shown that charcoal is used by 70% of the urban population and 5% of the rural population. Firewood, according to the same data, is used by 21% of the urban population and 91% of the rural population. Even in Monrovia, the use of charcoal is as high as 85%.

The dependence on diesel and gasoline generators has led to an average annual growth of petrol and diesel consumption by 14% since 2004. The electricity demand is also set to increase by 10-12% in the residential, commercial and institutional (RCI) subsectors by 2015. Considering the present energy scenario, the CO<sub>2</sub> emissions are expected to reach 647,000 tons of CO<sub>2</sub> in 2015 and 3,435,000 tons by 2038 for RCI subsectors<sup>10</sup>. The baseline data on which these projections are made are unreliable and hence, the actual emission data might be more than the projection data.

### **Scenario for growth in energy demand**

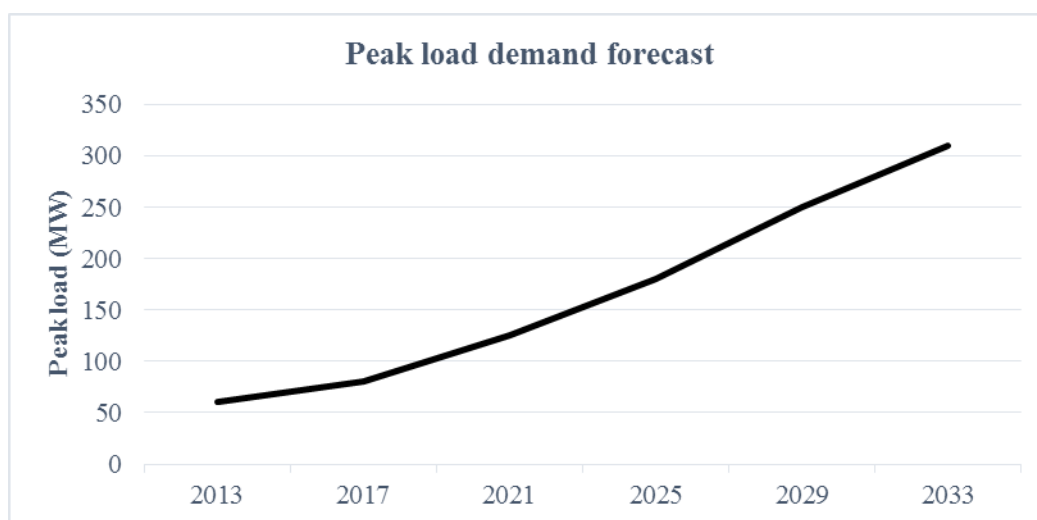
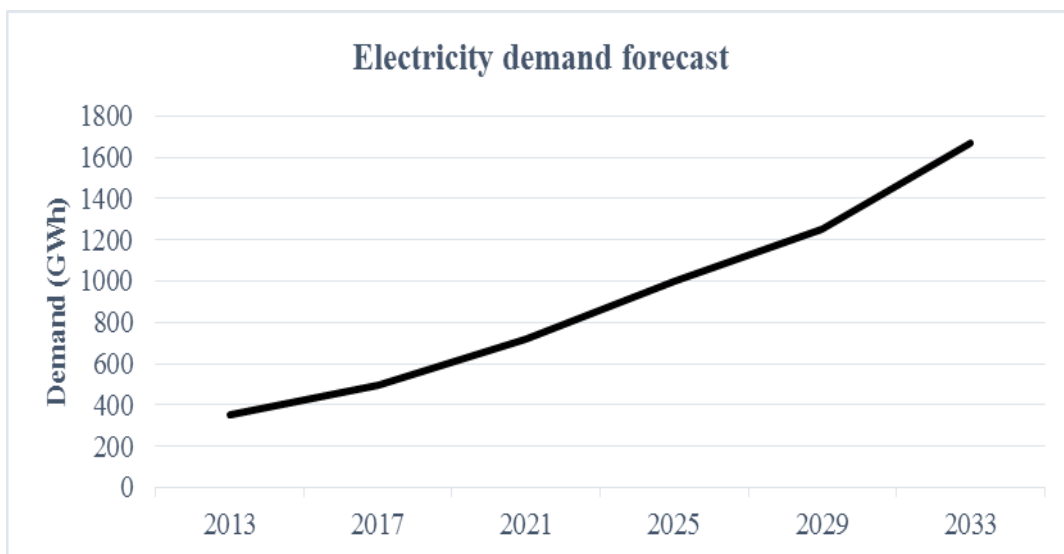
Although Liberia's total electricity consumption and power demand is low at present, it is expected to dramatically increase, driven by post-conflict economic development, and accompanied by rapid urbanization and soaring population growth.

In fact, a smooth growth rate in electricity demand is expected owing to availability of increased electricity supply at lower prices, with slightly higher growth rates between 2015 and 2020. After 2020, the growth rate

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<sup>10</sup> Source: mentioned in PIF

gradually slows in comparison to the average growth rate of 8%,<sup>11</sup> as consumers are expected to have a steady pattern for purchase of electrical appliances as well as through slowing population and GDP growth rates. However, in sum the energy needs of the country are expected to increase manifold in years to come. The following graphs provide an estimate of the net electricity demand and peak load forecast till 2033.<sup>12</sup>



Similarly, the peak load in Liberia is expected to increase to 310 MW in 2033 in the base scenario. The load forecast again follows the same path as outlined for the demand forecast above, and the total load demand increases between 2013 and 2033 by a factor of five.

<sup>11</sup> Source – AfDB’s Strategy Paper on Liberia

<sup>12</sup> Source - AfDB



## Need for energy efficiency

The government of Liberia is carrying out several infrastructure development projects with help from international development agencies to revamp its generation, transmission and distribution infrastructure. Although Liberia's total energy consumption is low at present, it is expected to dramatically increase, driven by post-conflict economic development, and accompanied by rapid urbanization and soaring population growth. Although the number of households served by LEC are poised to increase as a result of these projects, a significant share of consumers shall still be served by IPPs and diesel gen-sets in the foreseeable future.

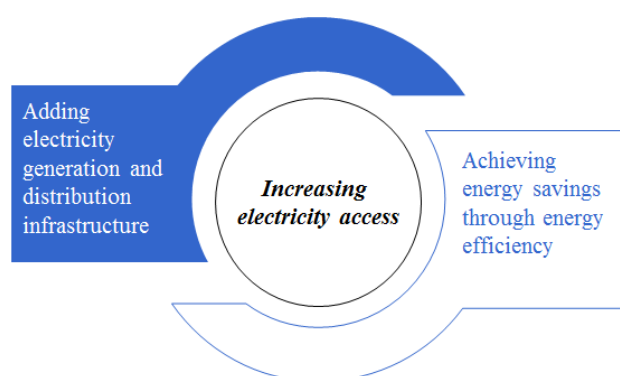
The refined petroleum usage for Liberia increased by almost 50% in between 2001 and 2010, from 3100 bbl./day to 4500 bbl./day. As of 2012, the entire petroleum consumption of Liberia of 3750 bbl./day is served through imports only. The increasing precedence of small gasoline and diesel generators has also another environmental consequence - noise pollution. While Liberia's total energy consumption and GHG emissions are apparently low, these figures are set to grow, given the energy demand that is being predicted.

The World Bank and EFTG had conducted a study in 2010 which projected the energy demand in Liberia by 2020 based on the economic scenario. According to the report, for the high and low growth scenario, the energy demand in Liberia would be 543 MW & 302 MW respectively. Even considering the low growth scenario, the existing infrastructure of the country is grossly inadequate to meet the predicted energy requirements.

Given this situation, the government of Liberia must provide massive investments for ratcheting up generating capacity to meet the expected demand by 2020 itself. In this scenario, introducing energy efficiency measures for reducing the net future demand in terms of both energy demand and peak load demand could help reduce the burden of investments to increase generation capacity in the future. For example, as per IEA data, "In OECD countries, efficiency measures reduce demand growth to 60% of what would otherwise be expected."<sup>13</sup>

In case of appliances, according to the IEA, "the most mature national appliance energy efficiency programs such as Standard & Labeling covering a broad range of products are estimated to save between 10% and 25% of national or relevant sectoral energy consumption". This implies that the implementation of an energy efficiency programme should be strongly focused, with realistic and effective policy measures in place. In case of Liberia, **even for a conservative estimate** it can be assumed that the reduction in demand due to energy efficiency measures in the country can reach up to 25% to 30%.

The cost of generation saved through energy efficiency can be utilized for other development activities such as increasing energy access, improving transport infrastructure etc. In this way, improving energy efficiency would indirectly help increase access to electricity and improve reliability of the grid as a result of fewer outages.



<sup>13</sup> Source: <https://www.iea.org/Textbase/npsum/WEO2015SUM.pdf>, accessed on 20 December 2016

Given this situation, **reducing future demand for energy by adopting energy efficiency measures in the country seems to be an ideal solution to avoid a certain share of the future generation capacity and reduce the GHG emission intensity.** Reforms in the demand side has the potential to reduce overall energy consumption as well as improve system efficiency without hindering economic output of the nation. This shall ease pressure on the supply side and provides an opportunity to rehabilitate and expand the energy infrastructure of the country as well as address the environmental factors.

There is huge opportunity for undertaking energy efficiency in Liberia as most of the new connections are yet to be added in next few years. It would be beneficial for the country and important for stakeholders to persuade consumers to go for energy efficiency at from the very beginning either the connection allotment stage because in this manner it is expected that returns in the form of energy savings can help local consumers and also the country in providing electricity to a larger consumer base.

Promoting energy efficiency & conservation in the country and unlocking its potential will be highly beneficial in several key areas, some of which are shared below.

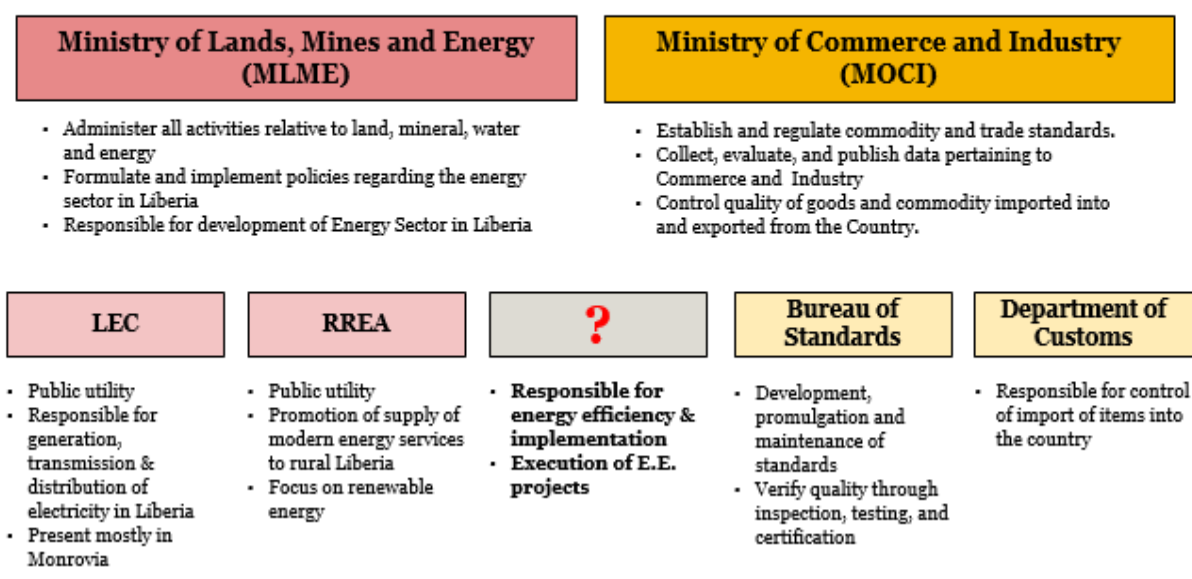
- Rising costs of production of electricity and marginally increasing tariffs are a cause of concern for the government. In years to come, population growth, economic development, urbanization, and industrial expansion will be the major drivers of rapid energy consumption in the country and energy efficiency can be the key contributor in providing energy access to all,
- It will facilitate enhancement in national policy coordination through stakeholder engagement,
- The introduction of energy efficiency policy measures in residential, commercial, industrial sectors will facilitate bringing regulations in the country through which use of inefficient processes and equipment can be avoided /discontinued,
- Increase awareness and visibility towards efficient use of energy,
- Carbon dioxide emissions will grow rapidly with the increase in consumption and can pose a major concern for the government. Energy efficiency measures helps address the environmental issues,
- It strengthens' competitiveness of local private sector manufacturers in the global marketplace and make local markets more attractive for multinational commerce,
- Promote multilateral and bilateral funding arrangements in the country for energy efficiency projects.

### **Existing barriers to uptake of energy efficiency in Liberia**

There are multiple barriers existing in Liberia that are impeding the uptake of energy efficient technologies in the country. These include:

- There is a need for a nodal agency for energy efficiency work in the country with clearly defined mandate and target areas or in simple words there is a need for a well-defined governance structure for energy efficiency. The structure can comprise of rules/byelaws for defining policies for energy efficiency; institutional setup required; stakeholder engagement strategy; and several coordination mechanisms. However, at the moment such a structured approach is not available in Liberia, therefore the institutional framework for the development and execution of energy efficiency policies and programs is weak. In order to understand the situation of governance structure in Liberia, the existing setup has been summarized next:

## Institutional set-up of the Liberian Energy Sector



- Although the NCCS is the key responsible entity for climate change mitigation strategies, however, institutional capacity of the NCCSC and the NCCS is weak, and as a result, the Committee and Secretariat have had limited progress in recent years,
- The existent baseline data on GHG emission, based on which policies are formulated, is weak and sometimes nonexistent. GHG assessments have been constrained by a lack of reliable and updated information on activity, which has made it difficult to conduct a quantitative assessment of mitigation options. According to its National Communication (NC) to the UNFCCC, Liberia has not previously conducted an assessment of GHG mitigation measures due to inadequate human resources, technological constraints, and the lack of data-gathering capability. A mitigation analysis and examination of options for reducing the sources of GHG emissions and/or enhance their sinks was conducted in Liberia for its NC, but there are still significant data gaps. With such unreliable data and technical incapacities, policy formulation is misdirected and effective monitoring, reporting and verification (MRV) systems are also flawed,
- Poor policy and regulatory environment – the policy framework for legal and regulatory functions of Liberia’s energy sector is uncoordinated and weak and the energy sector itself is fragmented with no proper coordinating mechanism,
- There exists a weak inter-sectoral and inter-agency coordination between relevant authorities. The roles of stakeholders and an engagement strategy for energy efficiency work is not available,
- Lack of technical expertise /capacity in energy efficiency technology and applications as well as potential policy incentives and measures among key stakeholders including MLME etc.
- Lack of awareness of policymakers and the public on energy efficiency,

This GEF financed project will seek to unlock these barriers and achieve energy efficiency benefits by supporting the institutional capacity of relevant ministries by providing the necessary policy, technical, financial support to relevant ministries to promote energy efficient appliances.

A detailed assessment of **country profile of Liberia** is discussed in **Annex: F**.

## 2) *The baseline scenario or any associated baseline projects:*

The government of Liberia is executing several projects with support from multilateral agencies to restore Liberia's generation and distribution infrastructure to meet the rising demand for energy. The projects include the Greater Monrovia Project, the recently concluded recommissioning of the Mt. Coffee Hydro Plant, the CLSG project and the LEAP project. The details of these projects are provided in Section B 'Consistency with National Priorities'. ***Together, these projects are expected to connect approximately 100,000 new consumers to the LEC network in coming years, both in rural and in urban areas.***

This will contribute to improved rates of access to electricity and expansion of LEC network in rural areas. However, even with successful execution of these projects, the electricity supply is unlikely to meet the entire energy demand, and a lot of potential consumers will not have access to public electricity at least till the medium term. These consumers will eventually turn to highly polluting diesel generators to meet their energy demands, if not done so already. The proportion of these consumers is likely to increase with the projected rates of economic growth and prosperity, which will increase the GHG emissions intensity of the country.

Compounding the supply side problem is the electricity tariff, which is about \$0.5/kWh, possibly the highest in Sub-Saharan Africa. The cost of electricity provided by IPPs and independent generators come out to be much higher, at \$1/kWh and \$1.5/kWh respectively. This is a major challenge for the government of Liberia in ensuring energy security to its citizens, a problem likely to intensify in the near future given the unpredictability of oil prices and poor road infrastructure in the country.

In such a scenario, the government will need huge investment for developing the generation capacity to meet the future energy demands. However, introduction of energy efficiency through Demand Side Measures (DSM) in Liberia, a market in which inefficient appliances are prevalent, will reduce the existing and future energy demand. This will free up financing resources for the government, which can then be used to expand the LEC distribution infrastructure and provide access to public electricity in rural areas.

But, the virtually non-existent capacity of policymakers and lack of any prior experience in executing projects related to energy efficiency are major barriers in realizing the potential of energy efficiency and reducing the added generation capacity due to reduced demand. In this scenario, without a targeted intervention to mitigate these challenges, the energy efficiency movement in the country is unlikely to commence. In the baseline scenario, the lack of necessary capacity of policymakers compounded with a complete lack of baseline data on energy access, consumption etc. will prevent the formation of any policy introducing energy efficiency in the country. There will also be limited public awareness on the benefits of use of efficient appliances, which will keep the market from shifting towards energy efficient technology.

### **Baseline scenario for component 1**

The present capacity and technical know-how of energy efficiency practices of the relevant ministries, including MLME, MOCI, MOFD etc. and the NCCS/EPA is non-existent. As a result, no policy or regulations or financial mechanisms have yet been developed in the country to promote the uptake of energy efficient appliances. This has also resulted in a lack of political will to invest in energy efficiency projects in the country. Complementing this issue is the complete lack of baseline data on energy access, consumption patterns and GHG emissions in the country.

Component 1 of the GEF financed project intends to create a scenario in the country wherein all stakeholders, especially policymakers are equipped with requisite capacity and knowledge to implement energy efficiency measures. Through the activities under this component, key stakeholders (which include MLME, LEC,

MOCI, RREA, NCCS etc.) will be provided the required training on energy efficiency, which will support these institutions in addressing and removing barriers, identifying solutions and implementing energy efficiency projects.

The component will also set in place policy and regulatory frameworks to foster accelerated GHG emissions mitigation mechanisms through the promotion of energy efficiency measures. Financial mechanisms to promote adoption of energy efficient appliances, including lighting will also be demonstrated and operationalized. **Without this intervention, it is unlikely that these institutions will develop the required capacity and provide a push to energy efficiency in the energy sector in Liberia.**

## **Baseline scenario for component 2**

Component 2 of the GEF financed project will intervene to generate awareness on efficient usage of energy, accelerate the commercial market providing efficient appliances and collecting data to identify the optimum way to scale up the use of energy efficient appliances in urban and rural Liberia.

This component involves implementation of a pilot program improving efficiency in public lighting. In the pilot program, 40,000 households (connections) will be identified and 2 LED bulbs per household will be distributed in exchange for incandescent bulbs. The energy savings are achieved as LEDs consumes about 90% less electricity for comparable quality of service than ICLs.

The energy efficient LED bulbs are now available in the local markets of Liberia and through this component the government focusses on increasing the uptake of LED bulbs. The program will provide the necessary thrust to generate public awareness and provide much needed experience in project management to relevant stakeholders.

The proposed GEF financed project will be implemented in tandem with the baseline project – LEAP for providing energy access to the consumers. The pilot demonstration coincides with those of the areas under baseline project. The areas covered under the pilot project are along the following locations:

- Monrovia – RIA corridor
- Pleebo-Fish Town corridor

The areas selected are such that they are **representative of the entire country and not limited to urban areas. The experience and knowledge gained from these areas would help execute the project to other counties in Liberia in the future.**

**Under the baseline situation, public awareness towards energy efficient appliances is unlikely to increase without the push provided by this component.** The policymakers and implementing bodies will also not gain any experience in conducting similar programs without the pilot program conducted as part of this project.

## **Baseline scenario for component 3**

Component 3 of this project focuses on utilizing the learnings and experience from the initial phases of the pilot project to identify the on-ground barriers to this coordination and strengthen it for the latter phases of the pilot project. Knowledge sharing and management is a key outcome of this component.

Replication of the pilot project on a larger scale will not be possible without knowledge sharing with key implementing bodies and policymakers. Equipped with this knowledge, they would modify the program/working model to address the practical constraints identified during the pilot program. **Identification of these constraints will not be possible without a thorough M&E of the pilot project, which is proposed under the baseline situation for this component.**

### **Baseline project - LEAP**

The proposed GEF financed project is intended to **complement the recently approved Liberia Energy Access Project (LEAP)** of the Government of Liberia. The purpose of the LEAP is to increase the Liberian population's access to electricity from the current 2% to 6% by 2020 and strengthen capacity in the electricity sector.

More specifically, the project will expand the transmission and distribution network, improve energy accessibility and efficiency in the LEAP's zone of intervention, and strengthen technical, managerial and institutional capacity of the energy sector.

The ultimate objective of the LEAP project is to connect a total of **additional 40,000** customers to the electricity grid in the project zone. The LEAP is designed to comprise of the following components:

#### **1. Component A – Transmission and Distribution system expansion and Rehabilitation**

Involves the construction of transmission lines, construction of substations and construction of distribution networks including connection services.

#### **2. Component B - Capacity Building**

Creating awareness among high school students on the opportunities in the electrical engineering and other technical branches at higher education level as well as organizing training sessions on power generation, transmission and distribution, and developing a training program on electricity distribution for MLME and LEC staff.

#### **3. Component C – Project Management**

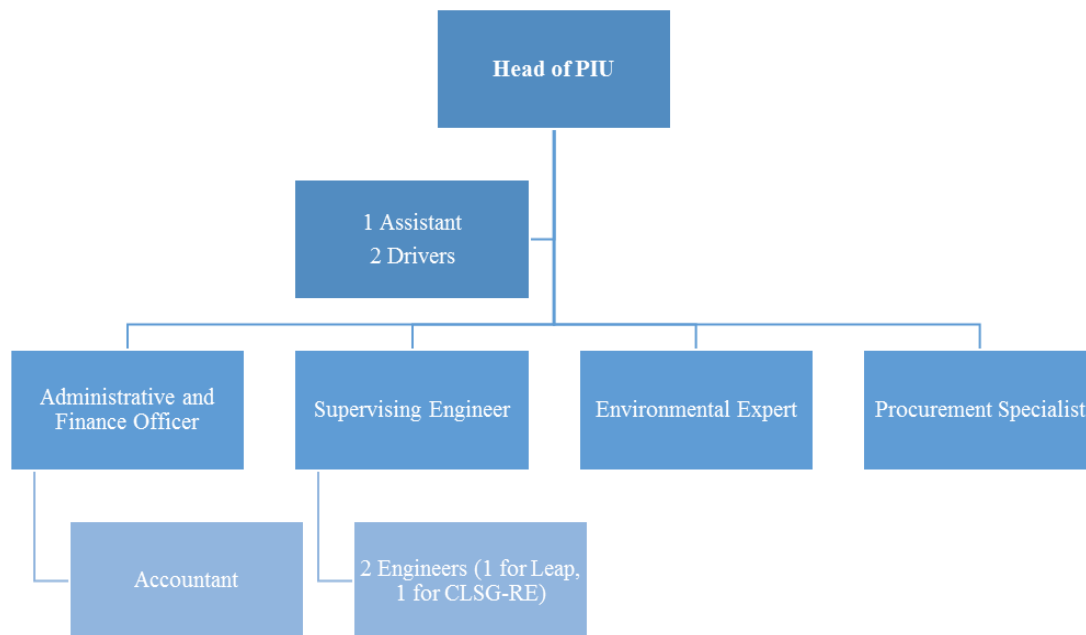
Adequate mitigation measures for adverse impacts that have been identified and included in the Environmental and Social Management Plan.

These measures will help improve operational efficiency of distribution system, thereby reducing GHG emission as well as reduce usage of highly polluting stand-alone diesel generators. **AfDB will provide financing of \$ 37 million and the project period is 48 months with planned completion in 2020.**

**Project locations:** The LEAP focuses on the Monrovia to Roberts International Airport (RIA) corridor and the Pleebo- Fish Town Corridor in Maryland and River Gee Counties in eastern Liberia. It will improve Liberian population's access to quality and reliable electricity services in the targeted areas.

### **Implementation arrangement for the LEAP project**

**The project will be implemented by the LEC.** The Project Implementing Unit (PIU) within LEC, which is already in charge of implementing the Bank financed Rural Electrification Component of the Cote d'Ivoire, Liberia, Sierra Leone, and Guinea (CLSG) Electricity Interconnection Project, will implement the project, in coordination with MLME, RREA and EPA regarding the capacity building component.



The project will be implemented by the existing PIU within LEC which is already in charge of the CLSG RE project. It will comprise personnel from the Planning, Procurement and Finance Departments of LEC. The project reports shall be consolidated through the planning department and forwarded to the Office of the Deputy CEO of LEC for onward submission.

***Expected project outcomes:***

- *46km of transmission line installed*
- *Two substations constructed*
- *280km of distribution lines constructed*
- *40,000 connections envisaged -13,000 through LEAP; rest through other projects*
- *Significant number of professional staff from LEC, MLME, RREA trained*
- *At least 100 students/technicians will be trained on a program to be established at vocational training centers*

***3) The proposed alternative scenario, GEF focal area strategies, with a brief description of expected outcomes and components of the project:***

The GEF financed project on “**Increasing energy access through the promotion of energy efficient appliances in Liberia**” focuses on promoting timely development, demonstration and financing of low-carbon technologies and mitigation options as per the CCM focal area. The project will focus on strengthening the institutional setup and providing necessary legal, policy, regulatory, and financial support to relevant ministries to promote energy efficiency in appliances, especially energy efficient lighting. This is especially relevant in Liberia, which is at present dominated by incandescent bulbs due to their low upfront cost. Also, the people in the country have limited awareness and knowledge about the energy efficient LED bulb technology in the country.

The incandescent bulb is the most conventional and inefficient lighting technology. The lighting sector have witnessed one of the greatest technological advancements and today the entire world is focusing on replacement of inefficient incandescent bulbs with energy efficient LED bulbs. A 60 W incandescent bulbs can be replaced with a 6 to 8 W LED bulb. Thus, there is a lot of potential of energy savings.

The GEF financed project takes a dual approach to promote the uptake of energy efficiency that is; addressing the hurdles in the energy sector governance to create a conducive environment for energy efficient technologies to develop; and eventually thrive and concurrently rolling out a pilot demonstration of exemplary technologies to accompany the baseline infrastructure investment. It comprises 3 components:

### **1. Component 1 – Institutional support & capacity building**

- a. Developing policy, planning and regulatory frameworks to foster accelerated low GHG development and emissions mitigation through the promotion of energy efficiency measures.
- b. Designing financial mechanisms to support GHG reductions and their subsequent demonstration and operationalization.

### **2. Component 2 – Energy efficiency lighting and public outreach**

- a. Effect accelerated adoption of innovative technologies and management practices to reduce GHG emission.
- b. Implement energy efficiency infrastructure in target areas.
- c. Increase public awareness and acceptance of energy efficiency and climate change.

### **3. Component 3 - Knowledge management**

- a. Project results and lessons learned captured and disseminated.
- b. Knowledge captured and shared with stakeholders to strengthen coordination and national knowledge base

The pilot program under component 2 **will be executed in the areas targeted as covered by the Baseline Project – Liberia Energy Access Project (LEAP)<sup>14</sup>.**

The GEF financed project complements the LEAP project (considered as the baseline project) – the LEAP project will restore the transmission and distribution infrastructure, and provide grid connections to 40,000 households (connections) across the project areas, the GEF financed project will support greening the initiative as well as create provide the necessary framework to replicate similar initiatives for promotion of other energy efficient appliances.

The GEF financed project also includes planning, execution and assessment of a pilot project in the proposed project locations. **The pilot project involves distribution of 2 LED bulb per household to replace the incandescent bulbs that are in use presently.** The target locations for the pilot program are:

- The Monrovia – RIA<sup>15</sup> corridor
- The Pleebo – Fish Town corridor

**The target beneficiaries for the pilot program are 40,000 households (connections) spread across the project area.**

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<sup>14</sup> Please see baseline section for information on LEAP project

<sup>15</sup> RIA – Roberts International Airport



## Alternative scenario proposed by the GEF financed project

The GEF financed project intends to create an alternative scenario in which all stakeholders including policymakers, utilities, statutory bodies and the end users are equipped with sufficient capacity and better informed to facilitate the uptake of energy efficient appliances in the country. This will ultimately catalyze the process of tapping the energy efficiency potential in Liberia and enable stakeholders to realize the benefits of reduced GHG-emissions intensity and reduced energy consumption in the country.

The project focuses on a three-pronged approach to unlock this potential for upscale of energy efficiency – (1) capacity building of policymakers in the energy sector, (2) execution of a full scale public outreach program to demonstrate the benefits of use of energy efficient technology, and (3) development of knowledge sharing mechanisms for capacity building. The direct and indirect outcomes of this project will include:

- **Enhanced capacity of relevant ministries and other stakeholders in the field of energy efficiency** – This will mitigate the present barriers of limited capacity of key ministries, lack of required knowhow in energy efficiency and lack of experience among stakeholders on benefits of energy efficiency. Once policymakers realize the need and benefits of energy efficiency, the present situation pertaining to lack of political will and unavailability of financing should also be mitigated.
- **Increased awareness among the public on use of energy efficient technology** – The pilot program will generate the necessary awareness among the consumers in the target areas on the most common benefits of energy efficiency – reduced electricity consumption and by extension, reduced electricity bill. This is especially true in Liberia since the tariffs are among the highest in the world. The pilot program may also facilitate better public reception towards other energy efficient technology in the future.
- **Stimulus in the market for LED bulbs** – The pilot program will involve procurement of 80,000 LED bulbs for distribution in the project areas. Procurement of such a large quantity of LED bulbs will involve discounts and therefore result in reduced prices of such technology through demand aggregation.
- **Development of policies to intensify the penetration of energy efficient appliances** – Increased capacity of policymakers will enable the development of policy frameworks and incentive mechanisms for upscale of energy efficient technology in Liberia. These would then form a part of a comprehensive Low Carbon Development Strategy for the country.

The outcomes, outputs and activities of the GEF-financed are described below for each component. Also, it is worthwhile to note that this project will not directly create new energy efficiency standards and codes, but the AfDB will work closely with national agencies which are developing and managing these energy efficiency standards and codes.

### **Component 1 - Institutional support & capacity building to support energy efficiency**

<i>GEF component</i>	–	<i>USD 700,000</i>
<i>Co-financing</i>	–	<i>USD 6,948,000</i>

The process of uptake of energy efficiency reforms in Liberia has been halted because of the presence of several institutional barriers in the country. These barriers include a lack of institutional capacity of key ministries, the NCCS/EPA and other stakeholders in developing and executing programs to promote energy efficiency practices. This can be attributed to the following reasons: lack of adequate know-how on energy

efficiency, unavailability of baseline data on sufficient baseline energy consumption and GHG emissions, weak financing, poor policy and regulatory environment, weak coordinating mechanisms among relevant ministries, fragmented nature of the energy sector, and poor political will.

Component 1 of the project intends to create an alternative scenario in the country wherein the stakeholders are equipped with requisite capacity and knowledge to implement energy efficiency measures.

The component will support relevant ministries in capacity building by providing necessary trainings to these stakeholders to develop and implement energy efficiency policies, and incentive mechanisms to promote uptake of energy efficient appliances in the country. The activities under this component include working with the relevant ministries to address and remove barriers, identify solutions and implement a set of policies to boost the energy efficiency profile within the Liberian energy policy landscape.

The ultimate outcomes expected as a result of this component include the following:

- Policy, planning and regulatory frameworks foster accelerated low GHG development and emissions mitigation through the promotion of energy efficiency measures
- Financial mechanisms to support GHG reductions are demonstrated and operationalized

### Expected outputs under component 1

The following outputs are expected under Component 1:

No.	Output	TA (USD)	Inv. (USD)
1.1	Capacity building through trainings provided to key stakeholders (including MLME, MOCI, MOFD, LEC, RREA, NCCS/EPA etc.) on drafting and implementing policy and regulatory frameworks for promotion of energy efficient appliances in Liberia to approach climate change mitigation.	220,000	-
1.2	Baseline data on energy consumption, electricity access, its distribution, electrical energy usage pattern, GHG emission etc. collected and documented.	180,000	-
1.3	Feasibility reports to expand energy efficiency infrastructure across sectors prepared. Target areas identified and action plans developed for implementing energy efficiency policies (as a part of a comprehensive Low Carbon Development Roadmap).	170,000	-
1.4	Incentive mechanisms (including non-subsidy) to encourage the uptake and mainstreaming of energy efficient appliances in project areas identified and developed (as a part of Comprehensive Sustainable Rural Electrification Framework Plan).	50,000	-
1.5	Policy and legislations for the gradual phase out of incandescent lamps identified and formulated, regulatory measures identified.	80,000	-
<b>Total (TA + Inv.)</b>		<b>700,000</b>	<b>-</b>
<b>Total (PMC)</b>			<b>20,000</b>

Output 1.1 is focused on providing trainings to key stakeholders including policymakers to carry out their roles in developing energy efficiency policies effectively. Conducting the training programs will generate the

required know-how of these stakeholders, thereby removing one of the major barriers halting this progress. The AfDB will provide financial support for conducting these training programs in the form of technical assistance.

It is anticipated that multiple training programs will be organised in the country so that a wider network of stakeholders could be covered. In total about **10 one-day training programs** shall be conducted and each program shall be attended by at least 20 professionals apart from organisers. The number of training program is tentative and shall be finalised during implementation stage.

Some of the key indicative objectives for the trainings shall be:

- Informing all stakeholders about the methodology for developing energy efficiency policies and measures, climate change programs. Knowledge sharing on important considerations for implementation of such policies and methods for monitoring & enforcements.
- Knowledge sharing on strategies for accelerating penetration of energy efficiency technologies and adoption of energy efficient appliances in the country
- Required regulatory and institutional structure for energy efficiency and climate change programs
- Address the key concerns of various stakeholders with reference to energy efficiency programmes. Bring different groups of stakeholders together under one platform and enable one-to-one communication. Describing the support required from stakeholders in terms of facilitating the data required for analysis, validating the inputs required for proposing the protocols and standards, required inputs for developing related policies, and reviewing the outcomes
- Increase visibility of proposed project activities
- Information on international best practices and case examples on similar programmes to be shared clearly

Output 1.2 focuses on mitigating the barrier related to unavailability of baseline data. Through this output, the required data will be generated which will be critical in development of energy efficiency policy framework and incentive mechanisms. Data on electricity access will be instrumental in developing the implementation plan for the pilot program to be conducted in component 2 of the GEF financed project. The entire data will be highly useful for developing policies in the future.

Output 1.3 seeks to establish action plans to expand the energy efficiency infrastructure in the future. This will form the basis for developing a Low Carbon Development Roadmap for energy efficiency and climate change initiatives in the future. The output aims to conduct a feasibility study and come-out with a roadmap for long-term energy efficiency strategy. This output directly follows output 1.2 where baseline data was generated.

Output 1.4 aims to support development of incentive mechanisms to incentivise the uptake of energy efficient appliances in project-areas in Liberia. These mechanisms would form an integral part in development of a comprehensive Sustainable Rural Electrification Framework Plan. This will establish the necessary policy framework required for promotion of energy efficient appliances in the country.

Output 1.5 intends to come out with a strategy for phasing-out inefficient lamps and uptake of energy efficient lamps. Developing such policies in Liberia would require a detailed assessment of demand of ICLs in the country at present, existing stock, availability of energy efficient lamps, key requirements and options available for phasing-out of ICLs, economic viability of the policy, proposed incentive structure, locations to

be covered etc. Such a detailed study will be conducted to support the ministries with relevant information as per output 1.2.

These outputs together essentially make a package of complimentary activities that together build a platform for energy efficiency based on collecting market intelligence, business and market development, financing, building institutional and consumer awareness, and public policy work.

## **Expected Activities under component 1**

The activities involved in achieving each of the above-mentioned outputs are described below:

### **1.1. Capacity building through trainings provided to key stakeholders (including MLME, MOCI, MOFD, LEC, RREA, NCCS/EPA etc.) on drafting and implementing policy and regulatory frameworks for promotion of energy efficient appliances in Liberia to approach climate change mitigation**

The activities to be implemented under output 1.1 are:

#### 1.1.1 Assessment of training needs

- Understand the capacity building needs of various stakeholders; understand the energy sector policies & achievements so far; Identify key gaps within the stakeholders in terms of understanding towards energy efficiency policy development & implementation; and broad expectations of the stakeholders from the proposed trainings.
- Based on the assessment, define the broad thematic areas /subjects to be covered under the proposed trainings. It would be prudent to highlight specific areas for each distinct group of stakeholders.

#### 1.1.2 Development of training curriculum

- Develop a training curriculum for about 10 programs with 20 participants in each program with indicative list of participants through discussions among key stakeholders including relevant ministries and AfDB.

#### 1.1.3 Development of training material and conducting trainings

- Develop training material in line with the training needs assessed in 1.1.1 in the form of presentations, case studies, training modules, materials etc. The firm shall prepare the detailed training schedule /agenda for each training program specifying the contents; timelines; list of trainers; participants; etc.
- Conduct trainings as per the training curriculum proposed in 1.1.2 and handle logistics.

### **1.2. Baseline data on energy consumption, electricity access, its distribution, electrical energy usage pattern, GHG emission etc. collected and documented**

The activities to be implemented under output 1.2 are:

- #### 1.2.1 Review of the existing data available with key stakeholders such as LEC, NCCS, EPA etc. Identify the gaps in the existing data and the information which needs to be collected that would support development of energy efficiency policy options in Liberia

### 1.2.2 Collection of baseline data through primary and secondary research

- Review and define the data to be collected such as: energy consumption in residential & commercial sectors; energy usage pattern; electricity access; demand of ICLs in the country; existing stock of ICLs; availability of energy efficient technologies; economic viability for energy efficient technologies; consumer preferences; awareness level in the country; etc.
- Conduct a thorough survey involving primary and secondary methodologies to collect requisite data that would support policy makers in coming out with realistic policies in the country.
- Analyse the data and prepare detailed report on findings and submit to relevant stakeholders.

### **1.3. Feasibility reports to expand energy efficiency infrastructure across sectors prepared. Target areas identified and action plans developed for implementing energy efficiency policies (as a part of a comprehensive Low Carbon Development Roadmap)**

The activities to be implemented under output 1.3 are:

- 1.3.1 Analyse the baseline data collected in output 1.2 and identify key areas/sector that have considerable energy efficiency potential
- 1.3.2 Engage with relevant ministries and key stakeholders in each area/sector to understand feasibility for energy efficiency measures
- 1.3.3 Prepare detailed feasibility reports for each area/sector and develop cost-benefit analysis. Identify key focus areas/sectors to be targeted for expansion of energy efficiency in the country through consultation with relevant ministries
- 1.3.4 Prepare action plans for developing and implementing energy efficiency policies through consultation with relevant stakeholders
- 1.3.5 Support NCCS in development of Low Carbon Development Roadmap for Liberia

### **1.4. Incentive mechanisms (including non-subsidy) to encourage the uptake and mainstreaming of energy efficient appliances in rural areas identified and developed (as a part of Comprehensive Sustainable Rural Electrification Framework Plan)**

The activities to be implemented under output 1.4 are:

- 1.4.1 Analyse the baseline data collected in output 1.2. Determine the possible interventions through energy efficient technologies /appliances in the rural and urban sectors.
- 1.4.2 Review of potential for energy savings through third-party assessment and thereby propose appropriate strategies for uptake of energy efficient technologies through incentive mechanisms
  - Develop financial and non-financial mechanisms to encourage adoption through consultation with relevant stakeholders
  - Recommend implementation framework for these mechanisms and finalise through consultation with relevant stakeholders

**1.5. Policy and legislations for the gradual phase out of incandescent lamps identified and formulated, regulatory measures identified**

The activities to be implemented under output 1.5 are:

- 1.5.1 Analyse the baseline data collected in output 1.2 with a focus on incandescent bulbs and its usage across Liberia. Also, review the availability of energy efficient LED lamps in the country.
- 1.5.2 Consultation with relevant regulatory, legislative & executive bodies to establish scope of program. Develop effective phase-out mechanism in consultation with relevant stakeholders
- 1.5.3 Generate draft policy paper and finalize policy with due discussion with stakeholders

**Component 2 – Energy efficiency lighting and public outreach pilot program**

<i>GEF component</i>	–	<i>USD 1,664,025</i>
<b>TA</b>	-	<b>USD 524,025</b>
<b>Inv</b>	-	<b>USD 1,140,000</b>
<i>Co-financing</i>	–	<i>USD 30,880,000</i>

The earlier sections of this document briefly discuss about the limited or non-existent awareness on energy efficiency among both the public and the policymakers that has been a major road block for the energy efficiency movement in Liberia. To address this challenge and drive the lighting market towards use of energy efficient products, a pilot LED bulb distribution program will be carried out to raise public awareness on the benefits of use of energy efficient products. Generating public awareness will eventually increase demand for efficient technology and, coupled with appropriate incentive mechanisms, will drive the market towards energy efficient products. The pilot distribution program will also provide to stakeholders and policymakers much needed experience in executing such projects, which is non-existent at present. The pilot program will also help identify challenges and barriers in implementation, which will be mitigated through appropriate actions. This will enable policymakers in Liberia replicate the program on a large scale in the future.

The pilot program will involve distribution of LED bulbs at 40,000 households (connections) across the locations targeted by the LEAP project – the Monrovia – RIA corridor and the Pleebo-Fish Town corridor. The pilot program will provide an ideal platform for policymakers to evaluate distribution methods, conduct outreach programs and collect baseline GHG emissions results from the project area. The pilot project will also increase the awareness of the public towards benefits of energy efficient lighting technology and encourage market transformation.

The GEF resources will most likely be used to provide market intelligence to the private sector on characteristics of marketable products and the willingness of consumers to pay; and conduct outreach and education campaigns and programs to inform, build awareness and enhance public acceptance towards energy efficient products and appliances. The ultimate aim will be to expand the uptake of innovative energy efficient technologies in the country which on one hand will contribute through energy savings & GHG reduction and on the other hand will create competitiveness in local markets.

Additionally, studies will be conducted on the current status of the density in the existing grids in the area, for the purpose of identifying barriers to intensification and to propose strategies and plans to address these barriers in the project areas in coordination with the energy efficiency work.

The outcomes of this component include:

- Accelerated adoption of innovative technologies and management practices for GHG emission reduction and carbon sequestration
- Energy efficiency infrastructure put in place in target areas
- Increased public awareness and acceptance of energy efficiency and climate change

The policies and mechanism developed specifically for the pilot program will be tested, and the practical issues will be identified through this component. Identification of these constraints will help policymakers develop effective schemes /mechanisms for replication of the pilot program across the country. The project will also initiate a baseline methodology for collecting emissions data from the project zones -- for activities under both the baseline investment as well as the GEF financed intervention.

The cost benefit analysis for the program is tabulated below. It clearly indicates that there exists a saving potential of 236.5 electricity units in a year by replacing an incandescent lamp of 60 W with a LED lamp of 6 W.

Parameters	Value	Unit
Power rating of incandescent lamp	60	W
Power rating of LED Lamp	6	W
Power saved per lamp	54	W
Operating hours per lamp <sup>16</sup>	12 hours /day @ 365 days in a year	hrs.
Energy saved per year	236.5	kWh/year
Electricity tariff <sup>17</sup>	1	USD/kWh
Cost saved per lamp per year	236.5	USD/year

The energy savings for the consumer is huge (to the tune of USD 230 per year), especially given the economic situation in Liberia. This signifies that there is a huge potential for energy savings through implementation of energy efficiency policies and programs, and will lead to indirect benefits such as improved quality of life of consumers (on account of the monetary savings achieved by the consumer).

Before proceeding on the expected outputs and activities under this component, it is first of all important to review the working mechanism broadly. The working mechanism to be followed during execution of the pilot program is described in detail in **Annex G - Pilot program execution methodology**.

Also, following case studies have been discussed in **Annex I** and **Annex J** respectively:

- An international case study: UJALA scheme in India

<sup>16</sup> Considering the assumption that a bulb is used for 12 hours per day and throughout the year for 365 days.

<sup>17</sup> Considering the assumption that electricity tariff for residential sector is USD 1 per unit.

- Lighting Lives in Liberia: Solar Lantern Project

### Expected outputs under component 2

The following outputs are expected from this component of the GEF financed project:

No.	Output	TA (USD)	Inv. (USD)
<b><u>Pre-distribution:</u></b>			
2.1	Conducted energy efficiency assessment of LEC network and provided technical support for intensification and identification of subsidy schemes which integrate energy efficiency	39,025	-
2.2	Pilot program preparation and pre-execution activities completed. Working model and distribution strategy (including timelines) of the pilot program finalized among key stakeholders	-	-
2.3	Standards and specifications for LED technology tenders developed	10,000	-
2.4	Public outreach programs on energy efficiency and climate change in project areas conducted. Pilot programs demonstrating subsidized energy saving lighting through LEC network in urban and areas for households and public spaces	75,000	-
<b><u>Distribution:</u></b>			
2.5	Pilot program involving distribution of LED bulbs (#80,000) at 40,000 households (connections) across project areas conducted. Capacity building training sessions organised for pilot project team for smooth execution of the program	50,000	1,140,000
<b><u>Post-distribution:</u></b>			
2.6	Recycling program for used lighting organized and initiated by LEC	35,000	-
2.7	Quality control protocols established and measures initiated. Reductions in energy consumption and GHG emission attributable to pilot program monitored, measured and reported. Results and experience of pilot program documented	245,000	-
2.8	Growth strategy drafted, based on experience and learnings from pilot program, for expansion of program in future	45,000	-
2.9	Needs assessment workshop on energy efficient products and appliances conducted in project areas for developing future strategies	25,000	-
<b>Total (TA + Inv.)</b>		<b>524,025</b>	<b>1,140,000</b>
<b>Total (PMC)</b>		<b>90,000</b>	

The outputs mentioned above will enable the PMU to conduct the pilot program demonstrating the benefits of use of energy efficient lighting in the project areas. The pilot program will address two key barriers impeding the progress of energy efficiency in the country: generate public awareness towards use of energy efficient appliances, and provide much needed experience to stakeholders in conducting a large scale program involving energy efficiency. Once these barriers are addressed, replication of the pilot program will be facilitated.



The GEFTF funds and the AfDB funds will be utilised for carrying out the pilot program in the selected project areas. The areas where the GEFTF & AfDB funding will be used include hiring and training of required personnel in the PMU, procurement of LED bulbs, and execution of the program.

Successful execution of the pilot program will help achieve the following objectives:

- Raise public awareness towards the benefits of use of energy efficient appliances in the project areas. Higher awareness among the people will result in greater demand for efficient lighting in the project areas. This will also lead to higher acceptance rates of other energy efficient appliances in the future.
- The LEC and other stakeholders will gain the much needed first-hand experience in executing energy efficiency projects in Liberia. This will result in identifying key barriers and developing mitigation measures for future projects. Therefore, scaling up and replicating the pilot program will be facilitated.
- The pilot project is likely to increase the market for energy efficient products in the country.
- The pilot project will result in a considerable reduction in baseline energy demand, peak load demand and GHG emissions intensity. This will likely result in increased political will to carry out similar such projects in the country.

## **Expected activities under component 2**

The activities involved in component 2 of the GEF financed project are described below:

### **2.1. Conducted energy efficiency assessment of LEC network and provided technical support for intensification and identification of subsidy schemes which integrate energy efficiency.**

The activities involved in output 2.1 are described below:

- 2.1.1 Conduct a study to assess energy efficiency potential within LEC network, the loading pattern of existing grids within the LEC network and identify recommendations for intensification along with uptake of energy efficiency technologies.

The baseline project LEAP aims for electrification and capacity building of people in Liberia. The proposed GEF project provides an additional benefit to the baseline project in terms of using the available electricity efficiently so that a larger set of people are benefited and they get more aware about energy efficiency. The study will be useful in coming out with schemes that aim for intensification of grid network in the country while also promoting usage of energy efficient technologies.

### **2.2. Pilot program preparation and pre-execution activities completed. Effective coordination with the LEAP project established. Working model and distribution strategy (including timelines) of the pilot program finalized among key stakeholders.**

The activities involved in output 2.2 are described below:

- 2.2.1 Establish effective coordination with the LEAP project for ensuring smooth execution of the pilot program.
- 2.1.1.1 Hold discussions among all stakeholders and the LEAP team to discuss program objectives, set expectations and working model.

- 2.1.1.2 Set up an effective coordination mechanism between the PMU and the LEAP team.
- 2.1.1.3 Prepare revised objective, working model and timelines based on outcome of discussions
- 2.2.2 Prepare a detailed implementation plan (including timelines and budget) for execution of the pilot program across the project locations. The implementation plan shall include a tentative schedule on awareness programs and distribution timelines among other details.
- 2.2.3 Hold discussions with the LEAP team to finalize the implementation plan.

### **2.3. Standards and specifications for LED technology tenders developed**

The activities involved in output 2.4 are described below:

- 2.3.1 Review of LED bulb technical specifications, pricing achieved, and procurement strategy adopted for similar programs implemented in other ECOWAS region countries.
- 2.3.2 Conduct meetings with local vendors /importers of LED bulbs in Liberia to understand the market dynamics, key brands available, technical specifications, availability of bulbs, etc. Define the specifications of LED bulb based on the review of local markets and other similar programs.
- 2.3.3 Define an indicative budget for procurement, procurement terms for inviting both national and international suppliers based on AfDB rules, terms and conditions for supply of bulbs, quality performance certificates required from the vendors, warranty coverage etc. through discussions with relevant stakeholders.
- 2.3.4 Preparation of tenders for procurement of LED bulbs as per AfDB's standard procurement procedures and practices. The tender document shall provide information including the detail specification of LED bulbs, services to be provided by the vendor (manufacturer/supplier of LED bulbs) for warranty, implementation schedule, location of delivery, penalty criteria in case of any conformities, etc.

### **2.4. Public outreach programs on energy efficiency and climate change in project areas conducted. Pilot programs demonstrating subsidized energy saving lighting through LEC network in rural & urban areas for households and public spaces**

The activities involved in output 2.3 are described below:

- 2.4.1 Review of public outreach programs conducted by stakeholders in Liberia such as AfDB, NCCS, MLME, etc. for other project initiatives. Conduct meeting with PIU responsible for LEAP within LEC to understand the most effective mode of outreach strategy for spreading awareness on energy efficiency, climate change and pilot project details amongst the consumers within the LEC network and even beyond. Based on the assessment prepare an outreach plan.
- 2.4.2 Develop the material for awareness and outreach activities such as design of posters, pamphlets, banners and radio advertisement content, and liaising with radio stations, etc.
- 2.4.3 Conduct outreach activities. The outreach activities shall be conducted by LEC through their network along with the support from local vendors /service providers in project locations.

### **2.5. Pilot program involving distribution of LED bulbs (#80,000) at 40,000 households (connections) across project areas conducted. Capacity building training sessions organised for pilot project team for smooth execution of the program**

The activities involved in output 2.5 are described below:

- 2.5.1 Engage local warehouses across project locations through LEC network/regional offices for storage of LED bulbs that will be procured from vendors and incandescent bulbs that will be collected from consumers.
- 2.5.2 Tenders prepared under output 2.4 floated for selection of firm to supply LED bulbs to the local warehouses. The bids received from the bidders shall be assessed on technical and financial criteria. The bidder (s) with maximum score as per the evaluation criteria shall be awarded the contract as per AfDB standard rules for supply of LED bulbs to the project locations.
- 2.5.3 Counters for distribution of LED bulbs set up in LEC offices across project locations as per the implementation plan.
- 2.5.4 The shortlisted supplier shall supply LED bulbs, at the site as per the schedule mentioned in the tender document.
- 2.5.5 The LED bulbs shall be distributed to the consumers in exchange for incandescent bulbs in project areas as per pilot program working model.
- 2.5.6 Safe transportation and storage of incandescent bulbs collected from consumers in exchange for LED bulbs to local warehouse (daily, at end of day)
- 2.5.7 Maintain stock at local warehouse (real time)
- 2.5.8 Capacity building training sessions organised for pilot project team for smooth execution of program. About 5 training sessions shall be organised to cover different regions of LEC network.

#### **2.6. Recycling program for used lighting organized and initiated**

Proper handling of replaced stock of lights is important. The personnel working should be using Personal Protective Equipment (PPE) while handling this stock. At the warehouse a designated area shall be allocated for storing hazardous materials, and segregation between damaged and undamaged luminaries. The warehouse shall have adequate ventilation arrangement to prevent the accumulation of toxic gases from the damaged bulbs.

The activities involved in output 2.6 are described below:

- 2.6.1 Review of procedures adopted in other ECOWAS countries for safe disposal of hazardous material. Also, review of the standard guidelines from AfDB on disposal of electrical luminaries. Based on the assessment, define the mechanism for safe disposal of old lamps.
- 2.6.2 A thorough review of the internationally accepted guidelines for safe disposal of lighting equipment shall be done. Also, review of procedures adopted in other ECOWAS countries for safe disposal of hazardous material and the standard guidelines from AfDB on disposal of electrical luminaries shall be done. Based on the review of internationally accepted guidelines, a mechanism for disposal of incandescent bulbs shall be defined for the proposed project.
- 2.6.3 Identify the agencies that have the authority for safe disposal of material in the West Africa region. Conduct the safe disposal of incandescent bulbs through an external agency.

**2.7. Quality control protocols established and measures initiated. Reductions in energy consumption and GHG emission attributable to pilot program monitored, measured and reported. Results and experience of pilot program documented.**

The activities involved in output 2.6 are described below:

- 2.7.1 For conduct of quality assurance hire an independency agency for supporting PMU. The agency shall pick samples from field (point of distribution to consumers) as per the quality control plan from project locations. The samples shall be tested as per the defined process and qualification for compliance shall be established. The agency shall submit a consolidated report for the quality assurance check conducted every month during the implementation.
- 2.7.2 Review the protocol for MRV explained in the working model section and design a MRV plan. Hiring of external firm to conduct the MRV for the LED bulbs. Determine the potential energy savings and GHG emission reductions.
- 2.7.3 Submission of MRV report to the PMU and GEF Agencies highlighting any deviation in the actual situation with respect to desired process.

**2.8. Growth strategy drafted, based on experience and learnings from pilot program, for expansion of program in future**

The activities involved in output 2.8 are described below:

- 2.8.1 Key lessons learned and recommendations documented based on experience of PMU, LEC and other implementing bodies.
- 2.8.2 Analyse the MRV report prepared in output 2.7 and determine gaps, and recommend mitigation measures.
- 2.8.3 Consolidate findings and prepare indicative growth and replication strategy through discussion with key stakeholders.
- 2.8.4 Prepare final growth strategy document and submit to stakeholders.

**2.9. Needs assessment workshop on energy efficient products and appliances conducted in project areas**

The activities involved in output 2.9 are described below:

- 2.9.1 Conduct assessment of acceptance of the pilot project in the country, its impact on multiple sectors of the society and potential for replication of this project for other energy efficiency technologies through an external agency.
- 2.9.2 The agency shall conduct a one-day workshop inviting national and international delegates in Monrovia to share the findings of the study and on-ground experiences from implementation of pilot project. The workshop shall provide an opportunity for local stakeholders and various national & international experts to share their thoughts on identifying key needs and define a roadmap for uptake of energy efficient technologies in Liberia. The agency shall prepare a report in the form of workshop proceeding and shall submit to the PMU.

### **Component 3 – Knowledge management and Monitoring & Evaluation (M&E)**

<i>GEF component</i>	–	<i>USD 150,000</i>
<i>Co-financing</i>	–	<i>USD 772,000</i>

This component focuses on sharing the knowledge and experience of the technology and approaches applied in the pilot project among all relevant stakeholders. This shall assist local stakeholders to replicate the project on a larger scale in the future. The component also includes development of a detailed Monitoring & Evaluation (M&E) document to assess the effectiveness of the first two components.

Knowledge and data generated from this project will help the country more effectively understand, learn and undertake energy access and energy efficiency issues, as well as climate change mitigation in Liberia. This component will aid the learning process by documenting lessons and challenges, and making them available during implementation, as well as through an online portal which can be developed as a platform for climate change mitigation interventions in Liberia. This will aid the policymakers in replicating the pilot project in other areas of Liberia.

The main outputs of this component include a monitoring and evaluation (M&E) plan, relevant periodical project reports, and strong coordination and exchange of information with the LEAP project.

The following objectives will be achieved from this component:

- Impacts of project as whole will be assessed, key challenges identified, and mitigation measures proposed. These will be implemented in future projects.
- Final project documentation will be prepared and made available online. This will help in knowledge dissipation to key stakeholders at the ministry level.

## Expected outputs

The following outputs are expected from this component of the GEF project:

No.	Output	TA (USD)	Inv. (USD)
3.1	Monitoring and evaluation work plan formulated and implemented, detailed M&E documentation produced	100,000	-
3.2	Lessons learned from the GEF financed project documented and knowledge disseminated on online platform to aid replication	35,000	-
3.3	Coordination with the implementation of LEAP strengthened through knowledge sharing and management	15,000	-
<b>Total (TA + Inv.)</b>		<b>150,000</b>	<b>-</b>
<b>Total (PMC)</b>			<b>15,701</b>

Outputs 3.1 focuses on conducting M&E of the GEF funded project, and draw key learnings and takeaways from its execution. Output 3.2 focuses on sharing these key learnings, along with those from Component 1 and Component 2 of the GEF financed project through a dedicated online platform so that these are available to all stakeholders. This will greatly increase the capacity of all stakeholders in conducting energy efficiency projects in the future.

Output 3.3 focuses on utilizing the learnings and experience from the initial phases of the pilot project to identify the on-ground barriers to this coordination and strengthen it for the latter phases of the pilot project. The output emphasises on thorough coordination with activities and actions under the baseline project i.e. LEAP.

## Key Performance Indicators for the GEF financed project

The Key Performance Indicators (KPIs) or project indicators include the following:

PERFORMANCE INDICATORS			MEANS OF VERIFICATION
Indicator	Baseline	Target	
<b>Project objective</b>			
1) Total power demand avoided (MW) 2) Total GHG emissions avoided	1) Zero (2017) 2) Zero (2017)	1) 4.32 MW 2) 28,973 tons of CO <sub>2</sub>	MRV of pilot project conducted to calculate impact. Also, the Mid-term and End-term project evaluation conducted to understand the overall impact of program on stakeholders
<b>Component 1</b>			
Policies/ incentive mechanisms for promotion of energy efficient appliances developed	No policy available (2017)	Policy (s) towards energy efficiency formulated	Assessment of policies targeting promotion of energy efficiency drafted/ tabled/ promulgated
Number of training programs held	Zero	The program are conducted as per implementation plan	Through M&E framework, surveys, attendance sheets and training feedback sheets collected post trainings
Data to assist formulation of energy efficiency policy	Data not available	Data collected	A database created and a report is prepared with analysis of collected

and execution of demo project is collected through primary & secondary survey			data. The database and report shall be presented to PMU.
An action plan for energy efficiency policies in Liberia prepared covering initiatives cutting across multiple sectors	Action plan not available	A detailed action plan is available to assist local authorities towards implementation of EE policies	The action plan in the form of a report is prepared, submitted and approved from competent authority
Incentive mechanisms developed	No incentive mechanisms defined	A guide for probable incentive mechanisms available	Incentive mechanisms developed/promulgated for promotion of energy efficient appliances
Policy & legislations developed	Not formulated	Available	Policies drafted/promulgated for phase-out of incandescent lamps
<b>Component 2</b>			
1) Public awareness on use of energy efficient lighting 2) Demonstration of energy efficient technology conducted through pilot program	1) Very limited awareness 2) Limited penetration of LED bulbs. Also the cost is high	1) Public awareness on EE lighting increased 2) Accelerated penetration of LED bulbs. Reduction in prices of bulbs	1) Survey in project areas under Mid-term and End-term evaluation conducted 2) Number of LED bulbs distributed. Reduction in process achieved
A report on subsidy schemes for intensification of grid infrastructure which integrates energy efficiency developed	Data not available hence there is no such policy	Data available to assist LEC and other local authorities for bringing new policies with ultimate aim of grid intensification and energy efficiency	Project documents and subsidy schemes developed
Implementation plan discussed amongst PMU and PIU within LEC and finalized	Not started	Discussed and finalized. The plan is available	Meetings held with PIU within LEC responsible for LEAP. Also, through submitted documents and Mid-term and End-term evaluations
LED bulb specifications and tenders for procurement developed	Not defined	Specifications available and defined	Verified through submitted documents and Mid-term and End-term evaluations
Number of public outreach programs /activities held	Zero	Conducted as per implementation plan	Verified through submitted documents /money spent and Mid-term and End-term evaluations
1) Number of LED bulbs distributed 2) Project areas targeted	1) Zero 2) Target areas defined in the project document covered	1) 80,000 2) Distributed as per implementation plan	MRV of project sites and Mid-term and End-term evaluations
Number of used bulbs disposed & recycled	Zero	Mechanism for safe disposal of ICLs established and bulbs disposed	A manual describing the complete mechanism developed and followed. Payment to vendor for safe disposal. Verification by checking inventory records.
1) Quality assurance process finalized and implemented. 2) The process for MRV documented in the project document reviewed and finalized. 3) MRV of project sites conducted 4) Documentation produced	1) Not available 2) Indicative draft steps documented 3) Zero 4) Not available	1) Quality assurance process and plan available 2) MRV process and plan available 3) MRV reports for available 4) Results from MRV and Quality Assurance documented	M&E of pilot program Quality assurance reports MRV reports

<b>Component 3</b>			
1) The project results verified through effective M&E (mid-term and end-term) 2) Knowledge database created and shared	1) No report available 2) Not available	1) M&E reports available 2) By 2020 a database of experiences and information gathered from the project objectives created and shared with public	Reports through mid-term and end-term evaluations.
Detailed M&E documentation produced	Not available	Mid-term and end-term evaluation conducted	Detailed M&E documentation produced

Based on the experiences of the PIU and results of the M&E, a final project report shall be made, which focuses on key learnings from the project and recommendations for next actions. These documents will be made available in public domain (online) for real-time access.

**The activities involved in achieving each of the above-mentioned outputs are described below:**

**3.1. Monitoring and evaluation work plan formulated and implemented, detailed M&E documentation produced**

The activities involved in output 3.1 are described below:

- 3.1.1 Identify Key Performance Indicators (KPI) and Data Points (DP) required for each component of the GEF financed project and finalize these through discussion within the PIC and the PMU.
- 3.1.2 Prepare indicative Monitoring & Evaluation (M&E) work plan and finalize with stakeholders. The work plan shall include a mid-term and final evaluation for the GEF financed project.
- 3.1.4 Conduct mid-term evaluation of the project through an independent agency. The agency shall conduct the evaluation and prepare evaluation report indicating key findings and recommendations for ensuring smooth execution of latter half of the project.
- 3.1.5 Conduct final evaluation of the project through an independent agency. The agency shall prepare the final project evaluation report indicating the objective achieved.

**3.2. Lessons learned from the GEF financed project documented and knowledge disseminated on online platform to aid replication**

The activities involved in output 3.2 are described below:

- 1.2.1 A consolidated document with information on lessons learned from Components 1, 2 and 3 of the GEF financed project shall be prepared. The ultimate aim shall be to assess the long term viability of energy efficient technologies, covering the following parameters:
  - Price reduction in terms of % of baseline
  - Market penetration
  - Participation % of the suppliers
  - Increase in manufacturing base



- Capacity building of stakeholders /institutional impact
- Disposal mechanism established, etc.

3.2.2 Prepare final document in consultation with key stakeholders. Also, upload the details in the website of MLME by creating a separate TAB for this project

3.2.3 Share final document through the online platform

**3.3. Coordination with the implementation of LEAP strengthened through knowledge sharing and management**

The activities involved under output 3.3 are described below:

3.3.1 Determine improvement areas in coordination with LEAP project by studying M&E documentation, experience in pilot program etc. and provide recommendations

3.3.2 Share findings with the PIC, PMU of the GEF financed project and the LEAP PIU in LEC to improve coordination

3.3.3 Finalize timelines for implementation of recommendations suggested in 3.3.1, and revise implementation plan

***4) incremental/additional cost reasoning and expected contributions from the baseline, the GEFTF, LDCF, SCCF, and co-financing:***

A summary of the alternative and business-as-usual scenario – overall and per component – is presented in the table below. It further explains the incremental reasoning behind the project.

<b>Business-as-usual</b>	<b>Alternative scenario</b>
<p>The present electricity demand and GHG emissions is low in Liberia on the backdrop of very low access to electricity in the country. However, the figures are rising and are set to rise exponentially on the backdrop of rise in population, post-conflict growth and general economic prosperity of the people.</p> <p>Although the government has initiated several grid reconstruction projects and invested in ratcheting up generation capacity of the LEC to meet the rising demand, massive amounts of investment will be needed to meet the future demand. Also, high polluting diesel generators comprise a considerable portion of the current generation mix.</p> <p>In this context, implementing demand side management measures in the country appears as a good option to reduce future demand, subsequent GHG emissions, and investment in generation projects. However, no progress has been made on this front on account of presence of several barriers, which include inadequate capacity of institutions,</p>	<p>The GEF project offers the complete package for starting the energy efficiency movement in the country – capacity building, trainings, policies &amp; incentive mechanisms, pilot projects and increased awareness.</p> <p>The GEFTF resources will be used to increase the capacity of government ministries and the NCCS in developing energy efficiency policies in the country. Stakeholders will be trained on executing energy efficiency projects. Public awareness and local experience in conducting energy efficiency projects will also be generated through a pilot program conducted in project areas.</p> <p>The outcomes of the GEF financed project is likely to result in increased awareness of policymakers and end users on benefits of use of energy efficiency products. Experience in conducting the pilot program will help stakeholders in conducting similar programs on a larger scale.</p> <p>The GEF project is poised to provide an ideal base for</p>

<p>lack of know-how, weak financing, non-existent awareness etc.</p> <p>Without the GEF financed project, the situation is unlikely to improve and introduction of energy efficiency in the country on its own does not seem likely.</p>	<p>implementing policy interventions in the energy sector in the country, and will help achieve the proven benefits of energy efficiency such as reduced demand and GHG emissions intensity in the long term.</p> <p>The reduced demand will eventually result in a reduction in need for import of costly fuel oil (especially diesel) which in turn will contribute to improved energy security for Liberian citizens.</p>
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<b>Business-as-usual</b>	<b>Alternative scenario</b>
<p><b>Component 1</b></p> <p>The institutional capacity of policymakers and relevant stakeholders in the energy efficiency domain is virtually non-existent. Relevant ministries and the NCCS lack the required technical know-how and have limited capacity in terms of number of skilled employees. There is also a lack of political will to invest in demand side measures and energy efficiency projects because of lack of awareness on benefits of energy efficiency measures.</p> <p>Another major barrier holding up the energy efficiency movement in the country is a severe lack of baseline data energy consumption pattern and GHG emissions. This has contributed to an establishment of a situation where there is no policy or regulatory framework governing/mandating the upscale of energy efficiency in the country.</p> <p>Also, there is very limited availability of financing options for energy efficiency projects, given the government’s priorities in infrastructure development projects.</p> <p>Given the situation and presence of several barriers, it seems that without a focused intervention for capacity development of key ministries, the situation is unlikely to improve.</p>	<p><b>Component 1</b></p> <p>The GEFTF resources will be used to provide technical assistance to the government of Liberia.</p> <p>Under the first component, relevant ministries and the NCCS will be provided the necessary training to develop their awareness towards energy efficiency. The training sessions will also comprise of contents intended to enable these ministries and NCCS to develop policies and incentive mechanisms to upscale energy efficiency in the country. Increased knowledge and capacity is likely address the barriers related to inadequate capacity and poor political will.</p> <p>The component also seeks the establishment of incentive mechanisms to enhance the uptake of energy efficient appliances in the country, especially in rural areas. A special focus is on gradual phase out of inefficient lighting. To achieve these outcomes, baseline data will be generated and key government stakeholders will be enabled to develop energy efficiency policies in the country.</p> <p>This component will address the existing barriers to development of energy efficiency policies in Liberia. The GEFTF financing will be used to conduct the training programs, collection of baseline data and development of action plans &amp; policies.</p>

<b>Business-as-usual</b>	<b>Alternative scenario</b>
<p><b>Component 2</b></p> <p>There is virtually no awareness on the benefits of use of energy efficient appliances among the public in</p>	<p><b>Component 2</b></p> <p>Under this component, the LEC will execute a pilot program involving distribution of LED bulbs to raise</p>

<p>Liberia.</p> <p>The population without access to electricity currently rely on burning firewood to meet their heating and lighting requirements. It is unlikely that they would be aware of energy efficiency and its benefits.</p> <p>Those with access to electricity predominantly use incandescent bulbs to meet their lighting requirements, probably because of lower initial cost. There is virtually no existent demand for efficient lighting products in the country.</p> <p>With increasing population and rate of access to electricity (either through LEC or IPPs or diesel generators), demand for lighting products will rise. Also, dominant use of inefficient appliances is straining the already fragile electricity grid through unnecessary burden. People also have limited awareness about energy efficiency which is one the barriers in penetration of efficient appliances/LEDs in the market. Given this situation, it is unlikely that LEDs will penetrate the market without increased consumer awareness and access.</p>	<p>public awareness on benefits of use of energy efficient products (in this case, lighting). The GEFTF funds will be utilised for investment in this pilot program. Under this program, 40000 households (connections) along the project areas will be provided with LED bulbs free of cost.</p> <p>Conducting this pilot program will serve the following purposes:</p> <ul style="list-style-type: none"> <li>• Increased public awareness on use of efficient lighting products. This will likely result in increased market demand for such products in the future.</li> <li>• Aggregation in demand results in reduction in LED prices in the market.</li> <li>• Avoided GHG emissions on account of use of efficient LED bulbs in the project areas.</li> <li>• Valuable experience gained by LEC &amp; implementing partners in executing mass public programs on energy efficiency. This will help identify practical constraints present in execution of such projects.</li> <li>• Increased potential to replicate such programs in other areas of Liberia. It is expected that close to 120000 households/connections would be added through other ongoing projects in future. These experiences can be used to plan interventions for these new connections.</li> <li>• Such a project is likely to lead to increased investing in such projects in the future.</li> </ul>
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Business-as-usual	Alternative scenario
<p><b>Component 3</b> Not applicable</p>	<p><b>Component 3</b> This component involves conducting Monitoring and Evaluation (M&amp;E) of the GEF financed project, and knowledge sharing with key stakeholders.</p> <p>Conducting M&amp;E will ensure that the project is executed smoothly. Frequent tracking of project progress will help identify ground-level challenges and identify mitigation measures for successful project completion. M&amp;E will also involve practical assessment of the project results and provide</p>

	<p>recommendations for future projects.</p> <p>Sharing the outcomes of the project will help the learning process by drawing lessons and showcasing results. The ultimate objective of this component is to apply the lessons from the programme in further projects and facilitate implementation of the programme on a larger scale.</p>
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**5) global environmental benefits (GEFTF) and/or adaptation benefits (LDCF/SCCF):**

The GEF-financed portion will improve the technical capability and know-how of the NCCS/EPA, MLME and relevant ministries and allow them to develop policy & regulatory frameworks for the promotion of energy efficiency in the country. This will be achieved by providing necessary trainings to relevant ministries and stakeholders, which is an integral part of Component A of this project. The training and knowledge material will also be made available for ready access. The policy frameworks and financial incentives designed to expedite the uptake of energy efficient technology in the country will result in substantial reduction in GHG emission intensity in coming years.

The pilot project to be conducted under component B of the GEF-funded project will result in three parallel benefits – (1) increased public awareness towards benefits of use of energy efficient technology, (2) direct GHG emission reductions achieved as a result of the pilot program, and (3) identification of practical constraints and barriers for replication of the program on a larger scale. Increased public awareness towards energy efficient technology will likely improve acceptability of such technologies in other sectors as well, and complement the efforts of the policies and incentive mechanisms developed by policymakers.

The pilot project will replace incandescent bulbs with LED bulbs in 40,000 households (connections), (2 bulbs per connection) in the project areas. This will result in reduction of annual energy consumption compared to the baseline situation and result in reduction in GHG emissions intensity in these households.

The exact amount of savings to be achieved are calculated as per the GEF-STAP methodology for energy efficiency and is shown below:

**TABLE 1: CALCULATION OF ANNUAL ENERGY SAVINGS**

Parameter	Units	Value	Remarks
Number of households (connections)	-	40000	As per PIF
Number of LEDs per household	LED/household	2	As per PIF
Number of LEDs to be distributed	-	80000	
Power consumed by incandescent lamp	W	60	As per PIF
Power consumed by LED lamp	W	6	As per PIF
<b>Power saved per lamp</b>	<b>W</b>	<b>54</b>	
Number of hours of use per day	hours	12	Assumption
<b>Energy saved per bulb per day</b>	<b>kWh</b>	<b>0.648</b>	
Energy saved per household per day	kWh	1.296	2 LEDs per household

<b>Energy saved per day for entire project</b>	<b>MWh</b>	<b>51.84</b>	<b>40,000 households (connections)</b>
Number of days of use per year	days	365	Assumption
<b>Annual energy savings for entire project</b>	<b>MWh</b>	<b>18921.6</b>	

For calculation of the total GHG reduction, only the direct GHG emission savings from the pilot demonstration (40000 households /connections switching to LED lighting) have been included.

As a result, it is expected that the pilot project will result in a direct GHG emission reduction of 28,973 tons of CO<sub>2</sub> during the project life time. **The grid emission factor of LEC is assumed to be 0.1160 tCo<sub>2</sub>/MWh and the life of LED bulbs is assumed to be 10 years for the purpose of the calculations.** It has also been assumed that the pilot program will be replicated in a total of 200,000 households, and will lead to a total indirect emission reduction of 144,865 tons of CO<sub>2</sub>.

Since this is the first project of its type in Liberia, it is possible that several practical constraints in implementation have not been taken care of during the project planning. However, these constraints shall be identified during the course of project implementation and subsequent M&E carried out in component C. This shall help in capacity building of stakeholders and further expansion of pilot project in other areas and other type of consumers in Liberia, resulting in further GHG reductions.

## *6) innovativeness, sustainability and potential for scaling up:*

### **Innovation**

The proposed GEF project is among the first initiatives in Liberia that focuses on the need to scale up energy efficiency in the country. Since Liberia has very limited experience in the field of energy, this project will bring in internationally tested practices and help Liberia tackle the various challenges it currently faces for promotion of energy efficient technology.

The project would **introduce new methods, practices, and products related to energy efficiency** to the body of existing energy policy, while also implementing a pilot to rollout equipment and appliances to demonstrate the feasibility of utilizing such equipment in different contexts in Liberia.

The capacity building and pilot demonstration projects are expected to deliver a much-needed push for the energy efficiency movement in Liberia, and the learnings from the pilot demonstration would enable policy-makers to replicate such a programme on the large scale keeping the local context in mind. This in turn would stimulate demand for energy efficient technology among the public, and eventually lead to market transformation.

The present lighting market in Liberia is composed mainly of inefficient incandescent bulbs, which consume about 10 times more energy than that of an LED bulb. Because of lack of awareness on energy efficiency of the end users, there is virtually no demand for efficient lighting technology. The pilot program will generate the much needed awareness for LED technology, which when coupled with effective policy measures will lead to phase out of incandescent bulbs and eventual market transformation.

Also, several initiatives will be taken to ensure sustainability of the thrust to achieve market transformation after completion of the GEF financed project. Not only will a growth strategy for replication of pilot program in other parts of the country be prepared under the component 2, but knowledge sharing and capacity building

of government stakeholders will also be conducted under components 1 & 3 to help them manage such programs in future and support the market transformation activities.

The proposed investment in the pilot programme shall also create a variety of jobs and provide opportunity for local firms to gain experience in this field. The demonstration shall also provide ample opportunity for the people of Liberia to decrease their spending on electricity bill and hence improve their quality of life.

More efficient energy practices shall provide a diversified way for Liberia to address energy access issues while providing a path to increasing the supply of available energy with reduced costs to those who need it most.

### **Sustainability**

This project will ensure the sustainability of the knowledge and capacities generated within it through the provision of institutional support to relevant ministries to support the formulation of forthcoming legislation, which will be made into national policy. Because this project will be translated into policy work, it will therefore contribute to creating a more conducive policy environment to achieve the objectives of this project, which is to support access to electricity while promoting the use of energy efficient lighting through the establishment of appropriate legal framework and financial mechanisms. Once this is translated into policy, project activities will become part of the Liberian legal and regulatory framework, which will guarantee that energy efficiency strategies, particularly the use of energy efficient lighting, will be utilized in the ways it was conceived as such within the original project objective.

Additionally, the project will provide technical and managerial support for planning and management related to the national grid in the form of trainings and workshops to build the institutional capacity for implementing renewable energy efficiency. The project can guarantee that knowledge is transferred, but it is integral that Liberian counterparts are retained to ensure institutional memory.

### **Potential for Replication**

The pilot program conducted as a part of the GEF financed project will target 40,000 households (connections) connected to the LEC network along the Monrovia-RIA corridor and the Pleebo-Fish Town corridor. An estimated annual net energy savings of 18.972 GWh is expected from the pilot program. However, because the pilot program only targets 40,000 connections connected to the LEC network, which is a very small portion of the consumer space in Liberia, there is huge potential for replication of the program. The growth strategy for replication of the pilot program developed in component 2 and knowledge sharing in component 3 will be instrumental for this purpose.

The pilot program can be replicated to those LEC consumers that are not included in the GEF financed project. The current estimates suggest that about 100,000 more consumers are poised to be added to the LEC network through few of the ongoing projects. To target these consumers, a strategy similar to the one adopted for this project can be adopted – LED distribution programs can be executed in tandem with these projects. If not, these consumers can be targeted through stand-alone programs.

The LED bulb distribution program can also be extended to those consumers which are not connected to the LEC network, a consumer segment not targeted by the pilot program of this project. Although the distribution & number of these consumers is not clear at present, estimates suggest that most consumers in Liberia are not served by the LEC network and use of diesel generators is prevalent, especially outside Monrovia. LED bulb distribution programs targeting such consumers have huge GHG emission reduction potential, since diesel

generators are more polluting than the LEC grid. Just as the previous case, these consumers too can be targeted both in tandem with other projects and through stand-alone programs.

The replication potential also exists in extending the scope of programs from efficient lighting to other appliances, such as fans or televisions. Although these appliances are not prevalent in Liberia at present, their numbers will increase as the Liberian economy develops and more consumers are provided access to electricity. The energy savings and GHG emission reductions achieved from the scale-up will be more prominent when the rate of access to electricity is ever increasing at a healthy pace in the country.

Capacity building and policy development as a part of component 1 of the GEF financed project will enable policymakers in the country to facilitate the uptake of energy efficient appliances in Liberia and transform the existing market. Equipped with the necessary capacity in terms of knowledge and manpower, these stakeholders will be instrumental in facilitating the execution of energy efficiency projects in the country. The policy work undertaken will create a supportive environment for the widespread replication of the pilot program.

Also, as the GEF financed project is aligned with the national priorities and AfDB’s strategies of increasing electricity access and sustainability of energy sector in Liberia, financing of similar projects would be relatively straightforward. There are several ongoing electricity infrastructure rehabilitation/development projects financed by AfDB, USAID, EU, The World Bank and the government of Liberia.

## **A.2. CHILD PROJECT?**

If this is a child project under a program, describe how the components contribute to the overall program impact.

**Not Applicable**

## **A.3. STAKEHOLDERS**

Identify key stakeholders and elaborate on how the key stakeholders engagement is incorporated in the preparation and implementation of the project. Do they include civil society organizations (yes  /no )? and indigenous peoples (yes  /no )?

This section is focused on the key stakeholders that will be involved in the implementation of the GEF financed project. In this section, the key stakeholders are identified, their key roles & coordination mechanism described.

### ***List of stakeholders***

<b>Stakeholder name</b>	<b>Abbreviation</b>	<b>Stakeholder type</b>
Liberia Electricity Corporation	LEC	Utility – publicly owned
Ministry of Lands, Mines and Energy	MLME	Government ministry
Department of Energy	DoE	Department in MLME responsible for energy affairs
Rural and Renewable Energy	RREA	State owned organization

Agency		
National Climate Change Secretariat	NCCS	Inter-ministerial coordination body for Climate Change mitigation
Bureau of Standards	BoS	Regulatory body within MOFD
Environment Protection Agency	EPA	Government body for Environment protection
Vendors	-	<ul style="list-style-type: none"> <li>• These will include vendors &amp; suppliers for LED bulbs.</li> <li>• Vendors for distribution &amp; storage of LED lamps, inventory management, marketing &amp; awareness campaign under project</li> </ul>
Civil Society Organisations	CSO's	Relevant CSO's will be identified, and involved in design, implementation and analysis of marketing of energy efficiency campaigns
Other stakeholders	-	These will include national experts, vendors, suppliers, local banks and financing institutions who will be participants in the training programmes and capacity building workshops

Detailed description of these stakeholders is provided in the Annex: K.

### ***Stakeholder consultation during PPG phase***

The GEF financed has been designed to run in tandem with the LEAP project and therefore will involve several stakeholders, both those in common with LEAP and exclusive to the GEF financed project. These stakeholders have their own expectations and requirements of the implementation design, and as a result, the project has been designed to address the priority adaptation needs identified by these stakeholders.

Consultations at PPG stage included: i) the stakeholder workshop on 2<sup>nd</sup> December 2016; ii) independent meetings with all major stakeholders; and iii) several discussions held via telephonic conference. The main purpose of the consultations was to identify: i) the existing capacities of various stakeholders involved in the GEF project; ii) similar ongoing projects that would aid in the project's implementation; iii) expectations of stakeholders from the GEF financed project; iv) relevant national policies and legislation; and v) additional information relevant to the baseline context in Liberia.

During project implementation, stakeholder participation will be coordinated to enable effective implementation of the GEF-financed project. The corresponding budget for the activity will then be transferred to the implementing partners in charge. Details of stakeholder participation will be finalised during project inception.

### **A.4. GENDER EQUALITY AND WOMEN'S EMPOWERMENT.**

Elaborate on how gender equality and women's empowerment issues are mainstreamed into the project implementation and monitoring, taking into account the differences, needs, roles and priorities of women and men. In addition, 1) did the project conduct a gender analysis during project preparation (yes  /no )?; 2) did the project incorporate a gender responsive project results framework, including sex-disaggregated



indicators (yes  /no ); and 3) what is the share of women and men direct beneficiaries (women 50%, men 50%)?

## ***Background***

Women and girls play an important role in Liberia's work force and household income generation, with women comprising 54% of the workforce and almost 80% of agricultural labour force. However, they face various structural constraints hindering them from effective participation in economic activities. These constraints have led Liberia to be ranked 38<sup>th</sup> out of 52 African countries in the African Gender Equality Index 2015 conducted by AfDB.

These constraints include limited access to inputs and services essential for carrying out their productive functions; lack of enabling environment to contribute effectively to the economy; absence from important key sectors and sources of employment such as public works and infrastructure rehabilitation; and male dominance in timber, mining and rubber, which are key sources of the country's economic base.

Also, due to the gendered division of labour at home, where they carry out a larger share of unpaid family work, more women are less able to remain in full-time employment. While all men and women in the informal sector face similar problems such as absence of social insurance scheme, exploitation, harassment from people in authority, including at border crossings, unsafe work environment, limited finance and business development services, women are more negatively affected due to their over-representation in this sector.

Recognising the need to improve women's standards of living and reduce gender disparities, the government of Liberia introduced a National Gender Policy to reduce the prevailing constraints constantly faced by women in the country. In addition, Liberia's National Environmental Policy recognizes and acknowledges the vital role that women play in conservation and the sustainable management of the environment and aims to ensure their participation in decision making on the implementation of environmental policies.

Through their management and use of natural resources, women provide sustenance to their families and communities. As consumers and producers, caretakers of their families and educators, women play an important role in promoting sustainable development through their concern for quality and sustainability of life for present and future generations. In this context, the National Environmental Policy further states that gender mainstreaming shall form an integral part of the basic training, social development, environmental and natural resource management. In environmental management, gender sensitivity shall be made a priority for sustainability and development.

## ***Impacts of project on gender disparity***

The GEF financed project will create impacts on various stakeholders and at multiple levels for the enhancement of energy efficiency in Liberia. Component 1 of the project will generate the required capacity among key stakeholders to plan out targeted interventions in the energy efficiency space through policy frameworks and implementation mechanisms. Implementation of these policies will drive the market towards energy efficient products. This will result in a reduction of the overall peak demand in the country in the short and the long term. This in turn allows the investment amount that would have been required to increase the generation capacity to be utilised for development in other areas, such as grid expansion and road transport redevelopment and thereby positively support both men and women of the country.

Component 2 of the project involves conducting a pilot program for distribution of LED bulbs across the target areas to enhance public awareness on benefits of use of energy efficient products. Use of LED bulbs will definitely reduce the overall energy consumption and hence overall household spending, given that the electricity tariffs are one of the highest in the world. The money saved can be utilized in other areas such as improved education and quality of living.

Given these outcomes, the GEF financed project contributes to gender equality by ensuring the following:

Benefits of GEF financed project	Impact on gender equality
Reduction in household spending	<p>The amount of money saved can be utilized for activities that improve gender equality:</p> <ul style="list-style-type: none"> <li>• Education of women and children</li> <li>• Quality of life</li> <li>• Increased savings</li> </ul>
Increased access to electricity	<ul style="list-style-type: none"> <li>• Improved quality of life</li> <li>• Lesser exposure to harmful emissions from traditional fuel sources such as firewood etc.</li> <li>• Reduction in household spending</li> <li>• Need for arranging supply of traditional fuel sources reduced (traditionally done by women)</li> <li>• Electricity access allows more time for studying in evenings, etc.</li> </ul>
Improved quality of lighting	<ul style="list-style-type: none"> <li>• Health risk reduced</li> <li>• General safety</li> </ul>

***Measures to take gender disparity into account***

Measures shall be taken during implementation of all components of the GEF financed project to take the gender disparity situation in Liberia into account. During the inception phase, a Gender Framework shall be developed to guide project implementation. The project shall maximize its outreach through engagement with existing women groups, collectives and self-help groups and/or other institutional mechanisms for social mobilization identified for each component.

Equal participation of men and women shall be ensured. It shall also be ensured that their opinions, beliefs and practices are heard and taken into account in message and materials development for awareness generation for the pilot program.

Media content prepared for awareness generation in project areas shall be reviewed to ensure that print, audio, video messages avoid gender stereotypes, and will be revised if necessary. The project shall ensure that women are portrayed in empowering roles wherever possible. A gender sensitive awareness generation program/communication plan for domestic consumers shall be developed for wider publicity and sensitization awareness generation program.

**A.5 RISK**

Elaborate on indicated risks, including climate change, potential social and environmental risks that might prevent the project objectives from being achieved, and, if possible, the proposed measures that address these risks at the time of project implementation. The various risks to the GEF funded project are as follows:

<b>Type of Risk</b>	<b>Description of identified risk</b>	<b>Rating</b>	<b>Mitigation measure</b>
<b>Inadequate capacity within LEC for pilot project</b>	Risks related to LEC's capacity to properly operate and maintain the project due to its limited capacity	Medium	LEC is currently being operated by Manitoba Hydro International (MHI) under a management contract. The contract foresees the provision of capacity building to LEC. The LEC is implementing entity for LEAP and is also going to implement component 2 of this project. In order to successfully implement the proposed project, the Bank and many other development partners will be providing support/capacity building to LEC.
Reputational issues:	There is a risk of lack of interest in the new product due to the entry of poor quality LED bulbs into the marketplace, and that may hurt the reputation of LED bulbs.	Medium	To counter this risk, the LEC will adopt global quality standards for LEDs and ensure products supported under the program meets these standards. Information campaigns will also educate potential customers on how to recognize quality products. LEC will work closely with Bureau of standards to define LED standards in place.  Finally, the LEC will work with Customs authorities to make them aware of the quality issues and enlist their help in stopping poor quality products from entering the market.
<b>Control Mechanism for the Exchange Program</b>	There is a risk of leakage of excessive amounts of incandescent lamps into the system and return of LED lamps in the market	Low	Though the leakage is not expected to be significant, a close supervision of the households on sample basis may be proposed project as part of the monitoring and evaluation effort.. In addition, the strategy of initiating the project with a pilot phase will allow address all these issues.
<b>Manufacturers /Vendors interest</b>	An additional risk is that the private sector may not be strong or interested enough to carry the lantern exchange effort due to its large scale and the relative newness of the off-grid lighting technology to Liberia.	Low	The project proponents are aware of this risk and have incorporated market facilitation strategy in pilot phase, which is aimed at building up the private sector to market and trade LED bulbs through business facilitation support.
<b>Experiences/ obstacles during 1<sup>st</sup></b>	The risk is that this is the first pilot in Liberia of this kind and the project may face a	Medium	The project proponents have identified a mitigation strategy to make this a successful pilot.

<b>lighting pilot</b>	number of challenges. Also scale-up potential is uncertain.		<p>The project team will engage with RREA, which is running a solar lantern pilot in Liberia. Their experiences will be very useful for this program.</p> <p>The project team will also use experience from international public sector Energy Service company (ESCO), EESL in India. They have run similar program for residential consumers and have replaced close to 200 million incandescent bulbs with LED bulbs.</p>
<b>Budget cost overrun</b>	Common physical and price variations may occur and affect the project completion, particularly in fragile state /post conflict countries where procurement processes do not always generate the required competition and may result in high prices due to high risk premiums	Low	The project has included adequate price and physical contingencies (10%) commensurate with expected price volatility in the country and region. The recent bidding processes for similar energy efficiency project areas have demonstrated a huge level of competition in the prices of technologies. Hence, it is anticipated that budget cost overrun risk will be very minimal and manageable.
<b>Political risk</b>	Changes in government priorities resulting in reduced support for the project, delays in activities and overall ineffectiveness of the interventions	Low	The proposed project is directly aligned with the government's medium and long term agenda of increasing energy access and sustainable development. Therefore, sudden change in government priorities is unlikely.
<b>Technical risk</b>	Lack of energy savings from deployment of efficient technologies	Low to Medium	<p>This risk can be attributed to one or more of the following: poor quality of LEDs, and hoarding of LED bulbs by households for future use.</p> <p>The Bureau of Standards will be engaged to develop a standard for LED bulbs. Also, the implementing entity set-up a quality assurance process and MRV mechanism prior to the pilot demonstration to ensure that the bulbs supplied are of acceptable quality.</p> <p>To reduce the chances of hoarding, the households shall be provided adequate information through outreach programs. Also, an effective M&amp;E strategy shall be adopted to ensure savings are achieved as per plan.</p>
<b>Usage risk</b>	<p>Usage risks are usually a direct consequence of use of appliance by the end users. These risks are usually beyond the control of the implementing entity. These risks include:</p> <ul style="list-style-type: none"> <li>• Inaccurate baseline</li> <li>• Non-conformity to standard</li> <li>• Non-functional appliance</li> <li>• Operational changes</li> </ul>	Medium	

	<ul style="list-style-type: none"> <li>Poor performance of bulbs</li> </ul>		
<b>Sustainability risk</b>	<p>The risks envisaged here include inability to scale up implementation and lack of financing beyond the project period.</p>	Low	<p>The inability of the project implementers to scale up the program could be because of: unavailability of financing, and practical constraints.</p> <p>It is expected that unavailability of financing should not be an issue given that energy efficiency is a low cost solution and is accepted worldwide. The cost-benefit aspect of the project is also solid to attract sufficient investment from financiers.</p> <p>For practical constraints, it is difficult to estimate those that can hamper upscaling of the project prior to the pilot program. However, very few constraints exist that cannot be accounted for by effective policies and modifying the implementation procedure as per requirements.</p>
<b>Regulatory risk</b>	<p>Regulatory risks arise due to change in regulatory environment in the region or country. They include:</p> <ul style="list-style-type: none"> <li>Interest rate fluctuation</li> <li>Energy price fluctuation</li> <li>Foreign exchange risk</li> <li>Regulatory changes in laws relating to tax concessions, etc.</li> </ul>	Medium	<p>The risk of change in regulatory environment is moderate in Liberia, especially with electricity tariffs and prices. This is because, it is anticipated that an increase /fluctuation in electricity tariffs would create opportunity for local consumers to adopt energy efficient practices so as to achieve energy savings, and therefore is likely to facilitate execution of the programme. However, such risks might also create delays in execution of programme which can be lead to difficulties in achievement of anticipated objectives.</p> <p>An effective awareness and outreach shall be conducted so that there is enough demand and appreciation of the proposed measures in Liberia which itself is able to sustain the execution and overcome such risks. Also, it is important for stakeholders and government departments to regularly discuss and monitor the project progress such that any issues and concerns gets addressed in a proactive approach.</p>
<b>Environmental risk</b>	<p>These include the waste stream generated from replacement of light bulbs or other appliances having hazardous material.</p>	High	<p>An effective mechanism for disposal of incandescent bulbs shall be adopted to ensure proper disposal. The detailed procedure for defining the mechanism is discussed in output 2.6 of component 2.</p>

	<p>For the proposed pilot demonstration project, if the collected inefficient bulbs are not destroyed they could be used again. This would defeat the purpose of the project and lead to over-estimation of environmental benefits associated with the project. Also, improper handling may lead breakage of bulbs which might lead to health issues.</p>		
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## **A.6. INSTITUTIONAL ARRANGEMENT AND COORDINATION**

*Describe the institutional arrangement for project implementation. Elaborate on the planned coordination with other relevant GEF-financed projects and other initiatives.*

The GEF financed project is an integral component of the LEAP project and will be executed in tandem with the project over a three-year period. Implementation of the GEF financed project will be coordinated by the AfDB.

The MLME will act as the overall Implementing Agency (IA) for the project and the pilot project will be executed by the LEC, which will also be responsible for procurement of goods/services and hiring of personnel.

The IA will oversee the project, and provide the technical assistance required to meet the project goals, while AfDB will be responsible for project supervision to ensure consistency with GEF and AfDB policies and procedures. A task manager (TM) will be appointed for this role, which will be based on AfDB's policies and standard hiring practices. The TM will participate in the: i) mid-term review and terminal evaluation; ii) clearance of reports; iii) technical review of project outputs; and iv) Project Steering Committee (PSC) meetings.

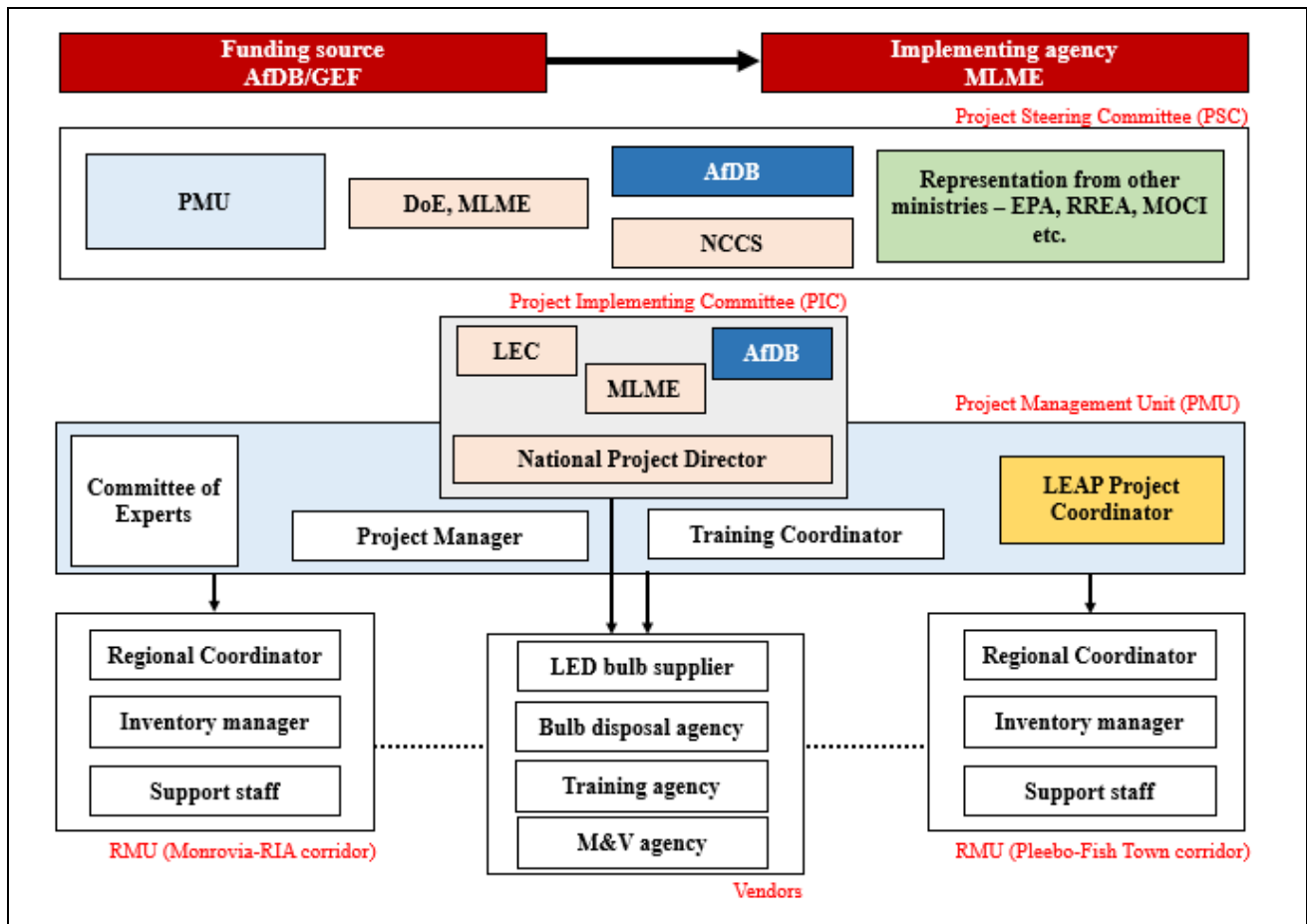
### ***Management structure***

Given the varying implementation requirements of the different components of the GEF financed project, and the large distance between the project sites, i.e. the Monrovia RIA corridor and the Pleebo-Fish Town corridor, a three-tier set of committees will be formed for the execution of the project – the Project Steering Committee (PSC), the Project Implementation Committee (PIC) and two regional Project Management Units (PMU). Their roles and responsibilities are described below:

- **Project Steering Committee (PSC)** will provide project oversight and advisory support, particularly for the Monitoring and Evaluation (M&E) plan.
- **Project Implementation Committee (PIC)** will be set up to provide guidance for project implementation. The PIC will comprise of AfDB, MLME, LEC and NCCS, and have representations from other key ministries.
- **Project Management Unit (PMU)** will be established to execute the project at the national level. This structure will include: i) a National Project Director (NPD); ii) a Project Manager (PM); iii) a Training Coordinator (TC); iv) an Administrative and Finance Officer (AFO); and v) an Office Assistant.
- Two **Regional Management Units (RMU)** will be established to carry out the LED bulb distribution work in the project areas in coordination with the LEAP project. One PMU will be set up for the Monrovia-RIA corridor and the other for the Pleebo-Fish Town corridor.
- A **Committee of Experts (CoE)** will be formed for providing technical support for project execution. The CoE will comprise of an:
  - ✓ Administrative /Finance expert,
  - ✓ Procurement specialist, and an
  - ✓ Environment specialist.

These experts will be appointed by the AfDB and will form part of the PMU.

The structural representation of the stakeholders is given below:



The **Project Steering Committee (PSC)**, chaired by the Minister of Lands, Mines and Energy (MLME) with members from the Ministry of Finance and Development Planning, EPA, RREA, and LEC will provide strategic direction and ensure the overall high-level coordination of the project. **The PSC of the LEAP project will also serve as the PSC of the GEF financed project** to ensure synchronization with overall project objectives at the national level. The mandate of the **PSC** will include: i) overseeing project implementation; and ii) reviewing annual work plans, project reports including any changes in Results-Based Framework (RBF) or timeline of project activities. The PSC will meet twice a year to discuss performance indicators and provide strategic guidance.

A **Project Implementation Committee (PIC)** will be established under the MLME. This committee will comprise of representatives from MLME, NCCS/EPA and the AfDB. The PIC will meet quarterly – or more frequently if necessary – to oversee project implementation and coordination. The PIC will provide guidance for project implementation and progress as per the approved work plan.

As MLME is the executing agency under the GEF financed project, the **Project Management Unit (PMU)** will be established under this government department. The PMU will be comprised of the National Project Director, the Project Manager, the Training Coordinator, the expert committee and support staff. This unit will support day-to-day project execution and will ensure:

- the quality of outcomes delivered by the GEF-financed project;



- the effective use of resources;
- appropriate procurement of equipment and consultation services;
- availability of financing to support project implementation; and
- efficient coordination among project stakeholders

As the Executing Agency, the MLME will retain overall responsibility for project outcomes and strategic guidance. One of the Officers of the MLME will be designated as the **National Project Director (NPD)**. The NPD will have complementary and mutually supporting roles of overseeing general project implementation and project management. The NPD will be accountable to the PSC and PIC for project implementation. Additional responsibilities of the NPD include overseeing the project execution, identifying challenges and barriers, and ensuring smooth coordination with the LEAP project.

A full-time **Project Manager (PM)** will be hired for the PMU to coordinate and execute the day-to-day activities of the pilot project. The PM will coordinate with the LEAP team in the LEC and will be responsible for execution of the pilot project, as per component B of the GEF financed project. The PM will: i) report to the NPD; and ii) manage the project in line with budget and work plans, and in accordance with GEF and AfDB guidelines. The PM will deliver monthly progress reports to the NPD. These reports will include information on the: i) status of activities; and ii) challenges encountered on the ground during project execution. The PM will also: i) report the on-ground situation of LED bulb distribution, ii) conduct all dealings with vendors involved, and iii) ensure coordination among all stakeholders related to the pilot program. Moreover, the PM will serve as a liaison among the PMU, the technical experts, and the government staff involved in project activities.

A full-time **Training Coordinator (TC)** will be hired for the PMU to manage and coordinate all the tasks under component A of the GEF financed project. The TC will ensure that adequate trainings are provided to relevant ministries and NCCS, as required under component A, and the pilot project execution staff in the LEC for smooth execution of the project. The TC will delivery progress reports to the NPD on the status of trainings conducted, trainings planned in the next two months and difficulties faced.

The Administrative and Finance Officer (AFO) will be based in the PMU and will assist in administrative and financial matters. These officers will: i) prepare quarterly financial reports to track internal expenditures; ii) drawing up a procurement plan; iii) track project procurement; iv) track legal instruments, v) report on expendable equipment, and vi) other activities.

A team of Experts will also be employed for the implementation of the project activities, and will form part of the PMU. They will provide technical support for specialised tasks that cannot be undertaken by DoE staff or the staff of the implementing partner organisations. The expert team will include an Administrative and Finance Officer, a procurement specialist, an inventory management expert and an environment expert. They will provide technical support to the LEC staff, and conduct tasks in their respective domains. **The procurement specialist will also serve as a Quality Control expert to ensure that the LED bulbs supplied by the LED bulb supplier are of sufficient quality.** The procurement specialist in the LEAP PIU will serve as the procurement specialist in the PMU for the GEF financed project.

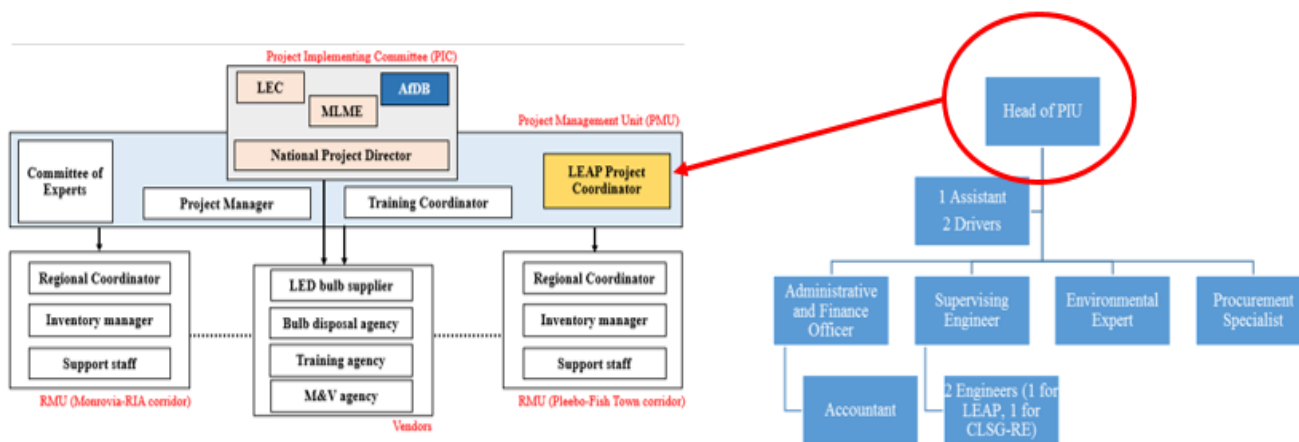
Since the pilot project will be carried out in two separate locations, the Monrovia-RIA corridor and the Pleebo-Fish Town corridor, which are very far apart, two independent **Regional Management Units (RMU)** will be deployed for execution of the pilot project on the ground level. The RMU will comprise a Regional

Coordinator (RC), an inventory manager (IM) and support staff. The RMUs will be formed under the LEC and will maintain full coordination with the LEAP team.

The **Regional Coordinators (RC)** will head the RMUs and will be responsible for overall management of the pilot project at the regional level. The RCs will: i) promote the timely execution of activities and the achievement of expected outcome of the project at the regional level; iii) promote dialogue key stakeholders particularly at regional and local level to facilitate smooth execution of the project; iii) visit and monitor the project sites regularly; vi) work in close collaboration and guidance of the PM and the NPD at the PMU. The RCs will provide daily status reports and LED stock/inventory updates to the PM.

**Coordination with LEAP project**

The pilot project under component 2 will **run in tandem with the baseline LEAP project**. The PIU within LEC, which is responsible for implementing the AfDB financed Rural Electrification Component of CLSG project, is also responsible for implementation of the LEAP project. The **implementing agency for the pilot program will also be LEC** and hence there is a strong need for establishing effective coordination mechanism between the existing PIU within LEC and the proposed PIC and PMUs under the GEF financed project. The organization structure of the existing PIU as well as the coordination arrangement under the proposed project is as shown below:



The pilot program under the GEF financed project will be conducted **simultaneously** with provision of electricity supply connections in areas covered under the Monrovia-RIA corridor and the Pleebo-Fish Town corridor. The two RMUs, under guidance from the PMU, will be responsible for distribution of LED bulbs and collection of incandescent bulbs. The RMUs will be established by LEC.

The RC within each RMU will be responsible for overall management of the distribution in the respective project area. The RC will coordinate with different stakeholders to arrange LED bulb stock at the LEC office on the day of the distribution and oversee the distribution process. The RC will report to the PM and provide daily progress reports and stock updates.

### **Additional Information not well elaborated at PIF Stage:**

**A.7 Benefits.** Describe the socioeconomic benefits to be delivered by the project at the national and local levels. How do these benefits translate in supporting the achievement of global environment benefits (GEF Trust Fund) or adaptation benefits (LDCF/SCCF)?

Component 1 of the project shall increase the technical and institutional capacity of policymakers and government stakeholders to address the negative effects of climate change by rolling out effective policies and financial incentive mechanisms. These policy interventions shall help increase the market share of energy efficient appliances, which is nearly non-existent at present.

Component 2 of the project shall increase public awareness on benefits of energy efficient lighting and hence shall increase demand for energy efficient appliances through the pilot demonstration. The pilot demonstration shall benefit all stakeholders, including MLME, LEC, consumers, and the environment.

Component 3 will aid key stakeholders & programme implementers draw key insights of the pilot demonstration by documenting lessons and challenges, and making them available during implementation, as well as through an online portal which can be developed as a platform for climate change mitigation interventions in Liberia. This will help replicate the pilot programme to other regions in Liberia.

Among the key national benefits that the project will bring are:

- Legislative and regulatory frameworks will be improved to promote energy efficiency in the country
- Significant savings in electricity consumption, and corresponding CO<sub>2</sub> emissions reduction in the long term
- The project will provide comprehensive information energy sector, detailed consumption statistics and related GHG's emissions reduction potential
- Development of new policies and strategies by the government
- Significant capacity will be built and will increase pool of professionals to implement energy efficiency on a large scale
- Significant awareness will be generated amongst professionals, decision makers, and the general public,
- Learning tools will be developed, including reports, training manual and software tools
- Households increase their purchasing capacity through reduced burden of electricity bills
- New jobs and business opportunities in energy domain, trainers, testing officials etc.

### **A.8 Knowledge Management.**

*Elaborate on the knowledge management approach for the project, including, if any, plans for the project to learn from other relevant projects and initiatives (e.g. participate in trainings, conferences, stakeholder exchanges, virtual networks, project twinning) and plans for the project to assess and document in a user-friendly form (e.g. lessons learned briefs, engaging websites, guidebooks based on experience) and share these experiences and expertise (e.g. participate in community of practices, organize seminars, trainings and conferences) with relevant stakeholders.*

The GEF financed project is the first project in Liberia in the field of energy efficiency, and therefore, ample knowledge building opportunities will be presented to stakeholders from experience gained during project execution. Knowledge management will ensure proper capture and documentation of knowledge and experience gained during the project, and make available key lessons to improve decision-making in future projects.

The proposed project will promote and implement effective management of knowledge within all the three project components. The following table details how knowledge will be effectively managed:

Project component	Contribution to effective knowledge management
Component 1: Institutional support and capacity building to promote energy efficiency	<ol style="list-style-type: none"> <li>1. <b><u>Improving knowledge</u></b>: Technical trainings will be provided for capacity building of key ministries and stakeholders in the field of energy efficiency.</li> <li>2. <b><u>Generating knowledge</u></b>: First hand data on baseline energy consumption and GHG emissions will be generated. Policies, regulatory frameworks and incentive mechanisms for promotion of energy efficiency will be developed. Key obstacles and challenges in developing policies identified.</li> <li>3. <b><u>Maintaining/sustaining knowledge</u></b>: All training material and content will be documented and shared in public domain. Experience during survey and key findings will be documented for future reference. Rationale behind all policies formulated will be shared and made available to all stakeholders.</li> </ol>
Component 2: Energy efficient lighting and public outreach pilot program	<ol style="list-style-type: none"> <li>1. <b><u>Improving knowledge</u></b>: Trainings provided to PIU staff to facilitate smooth operation of pilot project. Public awareness on benefits of use of energy efficient technology generated.</li> <li>2. <b><u>Generating knowledge</u></b>: Pilot program on LED bulb distribution executed at project locations. Knowledge on LED bulb supply, awareness raising, database management, inventory management etc. gained. MRV of pilot program conducted. Key obstacles identified.</li> <li>3. <b><u>Maintaining/sustaining knowledge</u></b>: Pilot program execution experience documented and shared with stakeholders. Detailed MRV results document prepared and shared.</li> </ol>
Component 3: Knowledge Management and Monitoring and evaluation	<ol style="list-style-type: none"> <li>1. <b><u>Generating knowledge</u></b>: M&amp;E of entire project conducted. Key findings documented. Recommendations for future projects made.</li> <li>2. <b><u>Maintaining/sustaining knowledge</u></b>: All findings and recommendations shared with key stakeholders and made available in public domain (online)</li> </ol>

## **B. Description of the consistency of the project with:**

### ***B.1 Consistency with National Priorities.***

*Describe the consistency of the project with national strategies and plans or reports and assessments under relevant conventions such as NAPAs, NAPs, ASGM NAPs, MIAs, NBSAPs, NCs, TNAs, NCSAs, NIPs, PRSPs, NPFE, BURs, etc.:*The GEF financed project will support the Liberian government in rolling out energy sector reforms by introducing policies for enabling the use of energy efficient technology. Promotion of energy efficiency will complement the government’s development agenda for the energy sector, and the pilot program will lead to considerable GHG emission reductions, during the project implementation and in the future. The policy development component of the GEF financed project is directly aligned with the country’s NAPA, which the country produced in 2008. Consistency with these programs/frameworks is described below:

### ***Consistency with Liberia’s Agenda for Transformation (AfT)***

Although the government has made considerable progress in the post-conflict period to revitalize the Liberian economy, several challenges still need to be overcome for Liberia to reach its targeted levels of growth. Among these challenges, the paramount ones pertain to weak infrastructure in the transport sector, and the poor state of the grid infrastructure in the country. To address these challenges and achieve the medium and long terms goals, the government has adopted the **Agenda for Transformation (AfT) for 2012-2017**, which describes the development agenda for the next five years.

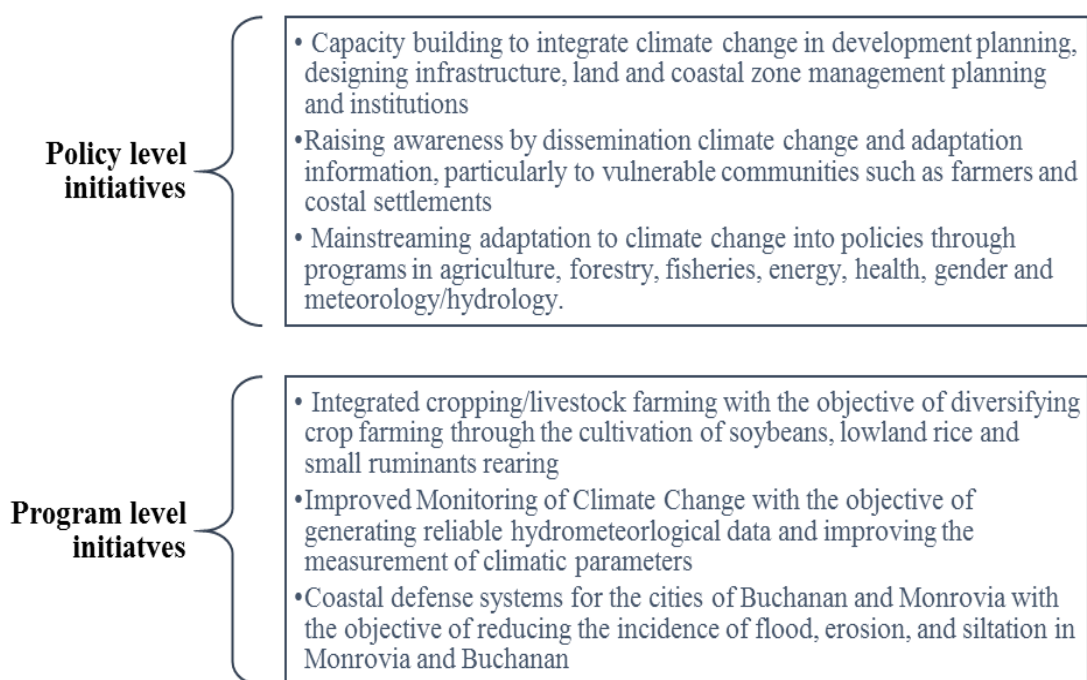
The AfT sets out precise goals and objectives that Liberia will achieve in the next five years in order to take the necessary steps toward its long-term goals. The AfT is consistent with the principles of the Paris Declaration, Accra Agenda for Action and the New Deal for Engagement in Fragile States. The AfT describes the specific goals and objectives across five pillars, which are described below:



Throughout the Agenda, the strategy focuses on creating more jobs, building infrastructure, generating energy and improving the quality of life that will spread the benefits of growth to all the citizens. This strategy recognizes that investment in energy, to unlock the urban economy, has the greatest return on investment and should be prioritized. **The proposed GEF financed project is in line with the AfT’s vision for development of the Liberian energy sector.**

### *Consistency with Liberia's National Adaptation Programme of Action (NAPA)*

Recognising the importance of a strong environmental governance system and an effective institutional and legal framework for natural resources and the environment, the government of Liberia developed its National Adaptation Programme of Action (NAPA) in 2008 to combat environment degradation caused by climate change, and to support the country's potential to achieve sustainable development and attain the MDGs. The government has identified several initiatives both at the policy level and the program level aimed at reducing the adverse effects of climate change while promoting sustainable development.



**The GEF financed project is completely aligned with the policy level priority action areas mentioned in the country's NAPA.**

### *Consistency with ongoing projects*

The GEF financed project focuses on increasing the penetration of energy efficient appliances in the market to reduce overall demand for electricity in terms of peak load and energy. This will result in a reduced burden of increasing the generation capacity of the LEC in the future and increase energy security and access in Liberia in the future. Therefore, the GEF financed project is in line with the national priorities and other grid infrastructure development projects that are ongoing in the country.

Few of these projects include:

- **Network expansion within Monrovia by closing the 66 kV ring and erecting additional 66/22 kV substations:** Within Monrovia, the 66/22 kV substations will be reinforced to become a design with circuit breakers on the 66 kV side and single bus bars with sectionalizers on the 22 kV side. Erection of a ring system of 66 kV lines is planned within Monrovia by closing the eastern ring with an additional line from Paynesville to Capitol and closing the western ring by erection of a line from Kru Town to Capitol.

- **Network integration of Mt. Coffee HPP:** For network integration, two double circuit lines 66 kV will be erected. A first route is planned from Mt. Coffee substation to Bushrod Island substation. The second line will be routed over 26 km to Paynesville.
- **Bushrod TPP:** A possible connection point for additional thermal power plants, such as large HFO diesel, will be Bushrod substation.
- **Ivory Coast cross-border project:** The ongoing project covers the eastern part of Liberia along the border to Ivory Coast. This region will be supplied from the power system of Ivory Coast. Therefore, the network connection of these regions is considered a minor priority.
- **LESEP – AF<sup>18</sup>** – The objective of the project is to **construct 49.08 km of 22 kV distribution lines in 18 communities across Monrovia** – Chugbor (468), Speaker Hill (242), RIA Highway (1000), Lower police academy (650), GSA road (600), King Gray (350), Saw Mill Community (286), Sayon Town (300), Billimah community (290) and King Peter town (300). **It is expected that a total of 8401 customers shall be connected in total.**
- **LACEEP (Kakata corridor)<sup>19</sup>** – This project focuses on the Kakata corridor. It aims to install a 56 km, 66 kV transmission line from Paynesville to Kakata, 1x10 MVA, 66/33 kV substation in Kakata, a 41 km 33 kV distribution line in Kakata, and an 82 km 22 kV distribution line in Paynesville. **The project aims to connect 10,300 customers to the grid.** The project commenced in September 2015 and is expected to complete by March 2017.
- **LACEEP AF (Bomi corridor)<sup>20</sup>** – This project focuses on the Bomi corridor. It aims to install 4 new substations of 10 MVA and extend the Paynesville and Bushrod substations. The project also aims to install a 66 kV transmission line in the Bushrod-Virginia-Kle corridor and a 22/33 kV distribution line in the project zone.
- **EU Monrovia consolidated project** – The LEC is working with the EU to expand the grid infrastructure across Monrovia. The project includes installation of a 2x10 MVA Congo Town substation, 66 kV transmission line Bushrod via stockton creek to capitol, 66 kV transmission line Bushrod to Krutown, and 22 kV distribution lines in Central Monrovia, Sinkor and Paynesville along with low voltage network. **The project aims to connect 46000 customers to the grid.** Project construction is expected to commence in the first quarter of 2017.
- **CLSG transmission line** – The project aims to connect 4 nations in **West Africa Cote d’Ivoire-Liberia-Sierra Leone-Guinea (CLSG)** through a 225 kV Transmission line in a cross border initiative. The line will run through seven counties of Liberia - Nimba, Bong, Bassa, Margibi, Montserrado, Bomi and cape mount. Liberia will receive initially 27 MW of power from this line. As of December 2, 2016, negotiations for the power purchase agreement (PPA) and transmission service agreement (TSA) have been concluded.
- **Greater Monrovia project for connection of the three corridors:** The intention of the greater Monrovia project is to expand the 66 kV network to the surroundings of Monrovia following the main corridors. **One corridor is from Monrovia to the Roberts International Airport (scope of the LEAP project).** The second corridor is from Monrovia to Tubmanburg, the capital of Bomi County. The third corridor is from Monrovia to Kakata, the capital of Magibi County. The distance

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<sup>18</sup> Source: LEC

<sup>19</sup> Source: LEC

<sup>20</sup> Source: LEC

from Paynesville to Kakata is about 52 km. Those last two corridors are being financed by the World Bank.

**Together, these projects are expected to connect approximately 100,000 new consumers to the LEC network in coming years, both in rural and in urban areas. These consumers can be targeted for replication of the pilot program of the GEF financed project in the future.**

### **C. Describe the budgeted M &E plan:**

Monitoring and Evaluation of the pilot project as a whole shall be conducted in 2 stages – the **Mid-term evaluation** and the **End-term (Final) evaluation**. The Mid-term evaluation shall be conducted to assess the progress of the project, ensure that it is moving in the right direction, identify key constraints hindering its smooth execution, and recommend amendments in approach to address these challenges. At the end of the Mid-term evaluation, revised implementation plan and schedule shall be prepared once amendments are finalized.

The Final evaluation shall be conducted to determine the benefits realised from executing the project. This shall be done by carrying out an on-ground survey in the project sites, conducting interviews with key personnel from ministries etc. to assess the impact of the project. Their responses shall be mapped against a set of Key Performance Indicators (KPIs) to understand the effectiveness of the project.

The implementation of various components of the GEF financed project will be overseen by the Project Steering Committee (PSC) and the Project Implementation Committee (PIC). The PSC will provide project oversight and advisory support, with particular focus on the Monitoring and Evaluation (M&E) plan. The PIC will be set up to provide guidance for project implementation.

The team of experts within the PMU will support in preparation of the reference, technical specifications and specifications relating to procurement of LED bulbs, assessment of various bids and proposals submitted for the procurement of various items envisaged, in cooperation with the technical expert, review and approval of reports and documents submitted by the contractor responsible for works implementation, etc.

Assessment of the impact of the activities conducted under the different components of the project will be overseen and implemented by the PIC. Bi-annual assessments of project progress will be presented to the PSC for their information and recommendation.

The following table describes the overall M&E plan:

<b>Report type</b>	<b>Prepared by</b>	<b>Responsibility</b>	<b>Preparation frequency/period</b>	<b>Submission</b>	<b>Budget allocation (USD)</b>
Stakeholder workshop report (s)	PMU staff	PM/NPD	Project inception and during the various phases of implementation	AfDB, PSC	\$5,000
Implementation progress and results reports (IPRR)	PMU staff	PM	Bimonthly	PIC, AfDB	PIU staff




Bi-annual Progress reports	PMU/PIC staff	NPD	Biannually	AfDB, PSC	PIU Staff
Mid Term Review Report	PMU/PIC with the support from an independent agency	NPD /AfDB	At mid-term of the project	AfDB /GEF Secretariat	\$10,000
Terminal Evaluation	PMU/PIC with the support from an independent agency	NPD / AfDB	At end of project	AfDB /GEF Secretariat	\$15,000

### **PART III: certification by gef partner agency(ies)**

#### **A. GEF Agency(ies) certification**

**This request has been prepared in accordance with GEF policies<sup>21</sup> and procedures and meets the GEF criteria for CEO endorsement under GEF-6.**

<b>Agency Coordinator, Agency Name</b>	<b>Signature</b>	<b>Date (MM/dd/yyyy)</b>	<b>Project Contact Person</b>	<b>Telephone</b>	<b>Email Address</b>
Mahamat ASSOUYOUTI African Development Bank		03/01/2017	Djamali IBRAHIME	+22520262549	D.IBRAHIME@AFDB.ORG

<sup>21</sup> GEF policies encompass all managed trust funds, namely: GEFTF, LDCF, and SCCF

## ANNEX A: PROJECT RESULTS FRAMEWORK

<b>Country and project name:</b>	Liberia – Increasing energy access through the promotion of energy efficient appliances in Liberia
<b>Purpose of the project :</b>	To increase the uptake of energy efficient lighting in Liberia by developing incentive mechanisms and conducting a pilot project in Liberia demonstrating the benefits of energy efficiency

RESULTS CHAIN		PERFORMANCE INDICATORS			MEANS OF VERIFICATION	RISKS/MITIGATION MEASURES
		Indicator	Baseline	Target		
IMPACT	To increase access to electricity in Liberia while promoting and mainstreaming the use of energy efficiency measures	1) Total power demand avoided (MW) 2) Total GHG emissions avoided	1) Zero (2017) 2) Zero (2017)	1) 4.32 MW 2) 28,973 tons of CO <sub>2</sub>	MRV of pilot project conducted to calculate impact. Also, the Mid-term and End-term project evaluation conducted to understand the overall impact of program on stakeholders	<p><b>Risk:</b> Unavailability of counterpart funding: The GoL is expected to contribute to the project's financing plan to finance environmental and social related measures including compensating the project-affected persons. GoL might find it difficult to mobilize such an amount on a timely basis</p> <p><b>Mitigation:</b> Relatively small amount of counterpart funding required; project in GoL's pipeline for many year and budgeted accordingly</p>
	<b>Component 1</b> - Capacity building of stakeholders to plan, develop, establish and execute energy efficiency policy and regulatory frameworks for promotion of energy efficient technologies	Policies/ incentive mechanisms for promotion of energy efficient appliances developed	No policy available (2017)	Policy (s) towards energy efficiency formulated	Assessment of policies targeting promotion of energy efficiency drafted/ tabled/ promulgated	
OUTCOMES	<b>Component 2</b> - Accelerated adoption of energy efficient technologies and increased public awareness through pilot program	1) Public awareness on use of energy efficient lighting 2) Demonstration of energy efficient technology conducted through pilot program	1) Very limited awareness 2) Limited penetration of LED bulbs. Also the cost is high	1) Public awareness on EE lighting increased 2) Accelerated penetration of LED bulbs. Reduction in prices of bulbs	1) Survey in project areas under Mid-term and End-term evaluation conducted 2) Number of LED bulbs distributed. Reduction in process achieved	<p><b>Risk:</b> Regulatory risks arise due to change in regulatory environment in the region or country. These include: Interest rate fluctuation; Energy price fluctuation; Foreign exchange risk; Regulatory changes in laws relating to tax concessions, etc.</p> <p><b>Mitigation:</b> The risk of change in</p>

	<b>Component 3</b> - Project progress and key lessons learned documented and shared	1) The project results verified through effective M&E (mid-term and end-term) 2) Knowledge database created and shared	1) No report available 2) Not available	1) M&E reports available 2) By 2020 a database of experiences and information gathered from the project objectives created and shared with public	Reports through mid-term and end-term evaluations.	regulatory environment is moderate in Liberia, especially with electricity tariffs and prices. However, an increase in electricity tariffs would increase energy savings for the consumer, and is likely to facilitate execution of the program if effective awareness is generated among the public.  A reduction in prices is likely for consumers of LEC. Also, the transmission and distribution network is unlikely to expand to the entire country till the medium term to affect project implementation.
<b>OUTPUTS</b>	Output 1.1 - Capacity building through trainings provided to key stakeholders on drafting and implementing policy and regulatory frameworks for promotion of energy efficient appliances in Liberia to approach climate change mitigation.	Number of training programs held	Zero	The program are conducted as per implementation plan	Through M&E framework, surveys, attendance sheets and training feedback sheets collected post trainings	<b>Risk:</b> Cost overrun of training programs <b>Mitigation:</b> simple design for open competition; 15% contingencies to deal with higher than normal bid prices  <b>Risk:</b> Weak capacity of implementing institutions: NCCS/EPA, MLME etc. - technical and administrative capacity is limited, therefore negatively impacting its ability to implement large projects <b>Mitigation:</b> measures to strengthen capacity (recruitment, training, etc.)
	Output 1.2 - Baseline data on energy consumption, electricity access, its distribution,	Data to assist formulation of energy efficiency policy and execution of demo	Not available	Data collected	A database created and a report is prepared with analysis of collected data. The database and report shall be presented to PMU.	

electrical energy usage pattern, GHG emission etc. collected and documented	project is collected through primary & secondary survey				
Output 1.3 - Feasibility reports to expand energy efficiency infrastructure across sectors prepared. Target areas identified and action plans developed for implementing energy efficiency policies	An action plan for energy efficiency policies in Liberia prepared covering initiatives cutting across multiple sectors	Not available	A detailed action plan is available to assist local authorities towards implementation of EE policies	The action plan in the form of a report is prepared, submitted and approved from competent authority	<b>Risk:</b> Changes in government priorities resulting in reduced support for the project, delays in activities and overall ineffectiveness of the interventions  The proposed project is directly aligned with the government's medium and long term agenda of increasing energy access and sustainable development. Therefore, sudden change in government priorities is unlikely
Output 1.4 - Incentive mechanisms to encourage the uptake and mainstreaming of energy efficient appliances in project areas identified and developed	Incentive mechanisms developed	Not available	A guide for probable incentive mechanisms available	Incentive mechanisms developed/promulgated for promotion of energy efficient appliances	
Output 1.5 - Policy and legislations for the gradual phase out of incandescent lamps identified and formulated, regulatory measures identified.	Policy & legislations developed	Not available	Available	Policies drafted/promulgated for phase-out of incandescent lamps	
Output 2.1 - Technical support provided for intensification and identification of subsidy schemes which integrate	A report on subsidy schemes for intensification of grid infrastructure which integrates energy	Not available	Data available to assist LEC and other local authorities for bringing new	Project documents and subsidy schemes developed	

	energy efficiency.	efficiency developed		policies with ultimate aim of grid intensification and energy efficiency		
	Output 2.2 - Pilot program preparation and pre-execution activities completed. Effective coordination with the LEAP project established. Working model and distribution strategy (including timelines) of the pilot program finalized among key stakeholders.	Implementation plan discussed amongst PMU and PIU within LEC and finalized	Not available	Available	Meetings held with PIU within LEC responsible for LEAP. Also, through submitted documents and Mid-term and End-term evaluations	
	Output 2.3 - Standards and specifications for LED technology tenders developed	LED bulb specifications and tenders for procurement developed	Not available	Available	Verified through submitted documents and Mid-term and End-term evaluations	<p><b>Risk:</b> Poor quality of LED bulbs – The LED bulbs may not be of sufficient quality, and therefore savings may not be achieved</p> <p><b>Mitigation:</b> All LED bulbs procured shall adhere to accepted local and international standards</p>
	Output 2.4 - Public outreach programs on energy efficiency and climate change in project areas conducted. Pilot programs demonstrating subsidized energy saving lighting through LEC network in urban and areas for households and public spaces.	Number of public outreach programs /activities held	Zero	Conducted as per implementation plan	Verified through submitted documents /money spent and Mid-term and End-term evaluations	

Output 2.5 - Pilot program involving distribution of LED bulbs (#80,000) at 40,000 households (connections) across project areas conducted	1) Number of LED bulbs distributed 2) Project areas targeted	1) Zero 2) Target areas defined in the project document covered	1) 80,000 2) Distributed as per implementation plan	MRV of project sites and Mid-term and End-term evaluations	<b>Risk:</b> Cost overrun – Unavailability of proper transport infrastructure and other services may increase costs. <b>Mitigation:</b> Simple design for open competition; 10% contingencies to deal with higher than normal bid prices
Output 2.6 - Recycling program for used lighting organized and initiated	Number of used bulbs disposed & recycled	Zero	Mechanism for safe disposal of ICLs established and bulbs disposed	A manual describing the complete mechanism developed and followed. Payment to vendor for safe disposal. Verification by checking inventory records.	<b>Risk:</b> These include the waste stream generated from replacement of incandescent bulbs having hazardous material. <b>Mitigation:</b> An effective mechanism based on internationally accepted standards for disposal of incandescent bulbs shall be adopted to ensure proper disposal
Output 2.7 - Quality control protocols established and measures initiated. Reductions in energy consumption and GHG emission attributable to pilot program monitored, measured and reported. Results and experience of pilot program documented.	1) Quality assurance process finalized and implemented. 2) The process for MRV documented in the project document reviewed and finalized. 3) MRV of project sites conducted 4) Documentation produced	1) Not available 2) Indicative draft steps documented 3) Zero 4) Not available	1) Quality assurance process and plan available 2) MRV process and plan available 3) MRV reports for available 4) Results from MRV and Quality Assurance documented	M&E of pilot program Quality assurance reports MRV reports	<b>Risk:</b> Hoarding of LED bulbs by households – LED bulbs distributed may not be used immediately by households, but stored for future use. Therefore, savings may not be immediately achieved <b>Mitigation:</b> Awareness programs to inform consumers for avoiding practice of hoarding.
Output 2.8 - Growth strategy drafted, based on experience and learnings from pilot program, for expansion of program in future	Documentation produced	Not available	The document finalized and findings disseminated	Inputs from local stakeholders towards the proposed growth strategy. Also, to be verified through End-term evaluation	<b>Risk:</b> The risks envisaged include inability to scale up implementation and lack of financing beyond the project period. It is expected that unavailability of financing should not be an issue given that energy efficiency is a low cost

						<p>solution and is accepted worldwide. The cost-benefit aspect of the project is also solid to attract sufficient investment from financiers.</p> <p>For practical constraints, it is difficult to estimate those that can hamper upscaling of the project prior to the pilot program. However, very few constraints exist that cannot be accounted for by effective policies and modifying the implementation procedure as per requirements.</p>
Output 2.9 - Needs assessment workshop on energy efficient products and appliances conducted in project areas	Workshop conducted	Zero	One workshop conducted	Workshop proceeding report produced		
Output 3.1 - Monitoring and evaluation work plan formulated and implemented, detailed M&E documentation produced	Detailed M&E documentation produced	Not available	Mid-term and end-term evaluation conducted	Detailed M&E documentation produced		
Output 3.2 - Lessons learned from the GEF financed project documented and knowledge disseminated on online platform to aid replication	Documents shared & uploaded	Not available	yes	Documents produced & shared online		
Output 3.3 - Coordination with the implementation of LEAP strengthened through knowledge	Coordination with LEAP PIU within LEC	Not existing at present	Effective coordination established	Minutes of meetings held, communication documented, knowledge sharing		

	sharing and management					
	<b>COMPONENTS</b>			<b>INPUTS</b>		
<b>KEY ACTIVITIES</b>	<p><b>Component 1</b> – Engage consulting firm to carry out training, finalize content and scope of training, and oversee execution of training &amp; submission of relevant documents. Engage agency for collection of baseline GHG data, analyze the data and prepare policies for enhancement of energy efficiency in Liberia</p> <p><b>Component 2</b> – Engage firm to supply LED bulbs for distribution, engage agency for distribution of LED bulbs and collection of incandescent bulbs, engage agency for disposal of discarded bulbs, engage firm for awareness raising, engage firm for overall project management. Liaise with all stakeholders &amp; finalize execution plan, and start execution</p> <p><b>Component 3</b> – Define M&amp;E protocols, engage firm to conduct M&amp;E of the pilot program, share results in applicable format</p>			<p><b>GEF-financing:</b></p> <p>Component 1 – USD 700,000</p> <p>Component 2 – USD 1,664,025</p> <p>Component 3 – USD 150,000</p> <p>PMC - USD 125,701</p> <p><b>Total – USD 2,639,726</b></p>		<p><b>Co-financing:</b></p> <p>Component 1 – USD 6,948,000</p> <p>Component 2 – USD 30,880,000</p> <p>Component 3 – USD 772,000</p> <p>PMC - USD 1,500,000</p> <p><b>Total – USD 40,100,000</b></p>



## **ANNEX B: RESPONSES TO PROJECT REVIEWS**

### ***Response to GEF secretariat comments not addressed at PIF stage***

	<b>Comment</b>	<b>Response</b>
1	<p>Are socio-economic aspects, including relevant gender elements, indigenous people, and CSOs considered?</p> <p>Please indicate how this project will benefit indigenous peoples if it is relevant.</p>	<p><u>At PIF stage:</u></p> <p>This section is not relevant for this project for now. However, further analysis will be conducted during project baseline appraisal report and documented in CEO endorsement</p> <p><u>At CEO Endorsement stage:</u></p> <p>Although the section is not relevant to this project, the potential impact of the project on gender disparity have been discussed in Section A.4. (Page 49) of this document.</p>
2	<p>In the CEO ER stage, please:</p> <p>(1). Remove CCM-1 Program 2 and put all project budget in CCM-1, Program 1, since the project cannot really create innovative policy packages and market initiatives.</p> <p>(2). Write one paragraph to show that this project will not directly create new energy efficiency standards and codes, but the AfDB will work closely with national agencies which are developing and managing these energy efficiency standards and codes, as indicated in the PIF already but not so evidently.</p>	<p>(1) The Table A has been revised to reflect only CCM-1, Program - 1</p> <p>(2) The project as design will not duplicate the existing standards and codes used in the country. In addition, the project institutional arrangements as described in the CEO endorsement document (Page 24) seeks to empower the national agencies in charge of the energy distribution and efficiency, including LEC, EPA, RREA, Bureau of Standards, etc.</p>

### ***Response to STAP's comments***

	<b>Comment</b>	<b>Response</b>
1	<p>..in a country such as Liberia where there is a major electricity constraint, it is unlikely that a reduction in total energy used and GHG reductions will result from energy efficiency measures since new demand will rapidly grow and absorb any savings resulting from efficiency measures. GHG emission reduction will more likely occur from the substitution of diesel generation with renewables. Even replacing incandescent bulbs with LEDs when powered by small, privately owned diesel/gasoline gensets</p>	<p>The energy sector situation in Liberia has been taken into account during preparation of the project, and the assessment indicators have been thus designed. The GEF financed project's impact will be assessed through IPMVP's deemed savings model for calculation of net energy savings and resultant GHG emission reduction. In the deemed savings model, the power saved per bulb will be first assumed, and the net energy savings will be assessed by carrying out a MRV survey in the project locations.</p>

	will experience this "rebound effect" in that the electricity saved may well be used for other purposes. The best indicator for monitoring any improvement in energy efficiency under these circumstances is energy intensity (such as GJ energy input per unit of GDP).	It is anticipated that energy demand will rapidly grow and absorb energy savings resulting from energy efficiency. Also, it is anticipated that use of renewables will bring reduction of GHG emissions more. These anticipations can be true and therefore the proposed project is a welcome step in the right direction. On one hand the project supports the energy access mission in Liberia by allowing consumers to save energy and on the other hand deploying energy efficient technologies within the facilities thereby reducing the capacity /load of renewables required to power-up those facilities.  The energy efficiency measure under the proposed pilot demonstration project is one of the most reliable and proven method for creating market for energy efficiency technologies in the country.
2	The deployment of energy efficient appliances will enable the operator/user to get the same energy services with less energy inputs. This will enable the same generation capacity to supply more people and businesses who can benefit from electricity access and move away from dependence on LPG, charcoal and fuelwood. Cost savings depend on the incremental cost increase for an energy efficient appliance over a standard model, and the amount of energy saved. A major shortcoming of this PIF is the fact that cost analyses were not presented.	The STAP committee's comments have been taken into account during the preparation stage, and detailed cost-analyses have been presented in this document. However, the standard correlation between incremental cost of energy efficient appliances vs. energy saved is not applicable in this project because the LED bulbs will be distributed to the public at no cost. However, the energy saved owing to the project has been calculated, and presented in section A1.5. Also, a case study of a similar program has been described in Annex I. This case study shows the execution of the program in India, potential benefits, and end results in terms of price reduction & energy saved. The lessons learned from this case study will be used for designing the replication strategy in Liberia.

### ***Response to France's comments***

	<b>Comment</b>	<b>Response</b>
1	...It would be helpful to indicate how the GEF subsidy will help overcoming this barrier, i.e. increase awareness about Demand-Side Management (DSM) for "final users" who are not yet connected?	The GEFTF funds will be utilised for capacity building of stakeholders & policymakers such as the MLME, RREA, MOCI, LEC etc. which will enable them to develop policies & incentive mechanisms on demand side energy efficiency measures in the near future.  The key component under the proposed GEF

		<p>funded project is implementation of pilot demonstration program where LED bulbs will be distributed to 40,000 household consumers across project locations. This implementation will be supported by extensive awareness and outreach programs for local consumers. The awareness programs will include those household consumers that are expected to be connected with LEC network and even those that are supplied by IPPs or diesel generators or not included in the pilot project.</p> <p>Also, since lighting constitutes a significant portion of the rural and urban household in Liberia, the reduction in energy consumption will result in a significant reduction of household electricity bill, given the high tariffs in Liberia. This impact is expected to aid in awareness generation among the population in project areas and beyond through word-of-mouth.</p> <p>Complementing this with effective policymaking &amp; incentives from the government’s side will aid the DSM initiative through energy efficiency in Liberia in the short &amp; medium terms.</p>
2	<p>The impact of the rural electrification project on climate change will be negative in the Medium Term. In this respect component 1 on institutional support is essential. Please indicate according to various development scenarios (Business-as-usual development model as reference) the benefits that will bring new energy efficiency policies, technology transfer and awareness campaigns</p>	<p>Introducing policies and incentive mechanisms for promotion of energy efficient technologies will be essential for Liberia to achieve its goals of providing electricity access and reliable supply by 2030. The benefits of introducing energy efficiency policies, when compared to the BAU scenario, include the following:</p> <ul style="list-style-type: none"> <li>• Reduction in GHG emissions in the short, medium and long terms</li> <li>• Reduction in investment required for generating the “avoided” power demand</li> <li>• Increased energy access &amp; supply for Liberian population</li> <li>• Indirect benefits such as improved quality of life etc.</li> </ul> <p>The GEFTF funds will support relevant ministries in capacity building by providing necessary trainings to these stakeholders to develop and implement energy efficiency policies, and incentive mechanisms to promote uptake of energy efficient appliances in the country.</p>
3	<p>Gender analysis is very interesting to carry out but such a social and economic study requires a huge work load and is time consuming. What is</p>	<p>Gender equality and its promotion are very important aspects of the baseline LEAP project. However, because the GEF financed project</p>

	the budget specifically dedicated to this study?	<p>specifically focuses on energy efficiency, which mostly has indirect benefits for gender equality, conducting a gender analysis study would be outside the GEF financed project's purview.</p> <p>The GEFTF funds have not been allocated towards conducting a gender analysis study. However, the training and capacity building programs proposed under the project will be undertaken with a focus on creating awareness amongst local women and female professionals in the organisations.</p>
4	A specific section to the benefits that access to energy will bring to the population regarding health center improvement would be welcome, in a country which was heavily impacted by Ebola (with also many indirect impacts)	<p>A key constraint to development and availability of basic services including health, law and order, sanitation etc. in all counties, with the exception of Montserrado, is lack of access to electricity. The baseline LEAP project focuses on developing infrastructure to increase access to electricity in the project areas. This will lead to improvement in the quality of life of people living in these areas, and because energy access is a key constraint for various sectors, the project will lead to improvement in delivery of basic services including health and education.</p> <p>The GEF financed project is designed to complement the LEAP project through energy efficiency, and increase the penetration of electricity access through the LEAP project. Therefore, this will enhance the LEAP project's initiative for increasing access to electricity in these areas.</p> <p>In sum, the GEF financed project will indirectly contribute to several sectors that would benefit from increased access to energy such as health (when clinics are provided reliable and relatively inexpensive energy), education, law and order, and gender equality etc. These have been highlighted in the section regarding gender equality (Page 49).</p>

### **Response to Germany's comments**

	<b>Comment</b>	<b>Response</b>
1	Regarding Component 1: Germany seeks clarification on how the identification of policies will translate into concrete actions. Following the identification of the policy and regulatory needs, for example, will an energy policy and strategy be agreed upon and implemented as a	Component 1 of the GEF financed project is focused on capacity building and policy development. Because unavailability of baseline data is the most crucial barrier in this regard, data collection has been included as a key output under component 1. Relevant policies and strategies for

	<p>prerequisite for implementing activities at the consumer level? In its present form, component 1 remains vague as to who will do what and who will be accountable. There is reference to a “NEP” but this is not defined anywhere in the proposal. If the NEP has stated goals for the energy sector, it would be helpful to include that in the proposal and how this project contributes to their fulfillment. Furthermore, how does this project complement the work of other energy-related initiatives? It is stated that the project will coordinate with LEAP and other projects in the country, but it is not clear what the division of labor is.</p>	<p>promotion of energy efficiency will be developed on the basis of this data. Post completion of the project, it is expected that policies &amp; incentive mechanisms will be implemented for replication of the pilot program in other areas in Liberia, and strategies will be adopted to improve energy efficiency in other sectors, if feasible. The responsibility of development of policies has been provided to the NCCS/EPA and MLME.</p> <p>Regarding the NEP, although Liberia has a National Energy Policy, it mainly focuses on energy access and has limited focus on energy efficiency. However, the GEF financed project is completely aligned with the country’s NAPA and Agenda for Transformation, as described in the CEO Endorsement document.</p> <p>Effective coordination with the LEAP project and its PIU has been described in the implementation arrangement section of the CEO Endorsement document.</p>
2	<p>Regarding Component 2: The focus is on replacing inefficient light bulbs, with additional work being done on grid improvements. Given the focus of the project justification on the use of charcoal and wood for energy and heat, the expectation is that Component 2 could also focus on improving energy and efficiency in the heating and cooking areas, as well. Furthermore, the proposal points out that the use of diesel generators is detrimental to the environment, but this problem also does not seem to be directly addressed by this project. There seems to be a disconnect between the motivation for the project and its proposed activities, which should be clarified. Is LEAP working with generators while this project focuses on lighting only? The project should refrain from contributing to a lock-in of diesel technology, and think of promoting future renewable energy development.</p>	<p>The present situation in rural Liberia is such that most consumers with access to electricity derive their supply from IPPs or independent diesel generators. To reduce the burden of diesel generators, the government of Liberia has initiated projects to connect more consumers to the LEC network. The baseline project, LEAP, intends to develop necessary infrastructure to connect 40,000 consumers to the grid in the project areas to reduce or avoid consumption of diesel.</p> <p>The GEF financed project is designed to introduce energy efficiency in households of the LEAP project area, so that unnecessary GHG emissions can be avoided. Policies to implement energy efficiency will also be developed through the GEF project.</p> <p>The energy efficiency component will support provision of grid access to more households for the same amount of investment. In this way, the GEF financed project supports phase out of diesel generator use and promotion of energy access through renewable energy.</p>
3	<p>Regarding Risk Management: The first risk named is “Limited Power Generation” and the proposed mitigation measures states that financing has been secured for three thermal</p>	<p>The HFO thermal power plants are part of the government of Liberia’s initiative to improve the generation capacity in the country, which include reconstruction of the Mt. Coffee Hydro Power</p>

	plants run on Heavy Fuel Oil (HFO). Is the GEF project involved in securing that financing? Please explain how the lock-in of fossil fuel infrastructure is justified for a project aimed at GHG savings. Germany does not favour the use of GEF-funds for investments contributing to locking-in emission-intensive activities	Plant as well. The GEF financing is not involved in the HFO thermal plants, but only focus on tapping the potential for energy efficiency through policy development & increasing penetration of energy efficient lighting. These energy efficiency measures will result in avoiding, and thereby reducing compared to the BAU situation, GHG emissions in the country.
4	Coherency Issues: It is not clear in the section 1.2 “1.2- The baseline scenario and any associated baseline projects” if the proposal is referring to the LEAP project or the proposed GEF project. It goes on to describe three components that do not align with either the LEAP project components or with the GEF project proposal’s components, and Component C is cut off in mid-sentence. This is followed by a map of Liberia with some drawings on it, which are not labelled. Please provide a description of what the map is depicting, as well as rework the language in this section for clarity so that it is clear which project is being described and which components correspond to which project.	The particulars mentioned in this comment have been addressed during the project preparation stage. For example: <ul style="list-style-type: none"> <li>• The baseline sections have been modified to provide clarity on these issues</li> <li>• The map of Liberia depicting the project areas, and the subsequent description, have been updated to provide better clarity</li> </ul> The CEO Endorsement request can be referred for more details.
5	The proposed alternative scenario could be updated to take into consideration the newly agreed upon UN Sustainable Development Goals, which are the follow on to the MDGs referenced in the proposal. (Goal 7: Ensure access to affordable, reliable, sustainable, modern energy for all.)	The section regarding consistency with national priorities in the CEO endorsement document describes the GEF financed project’s consistency with the country’s Agenda for Transformation and its NAPA, which focus on achieving part of the MDGs and SDGs.

**Annex C: Status of implementation of project preparation activities and the use of funds<sup>22</sup>**

A. Provide detailed funding amount of the PPG activities financing status in the table below:

PPG Grant Approved at PIF: <b>\$100,000</b>			
<i>Project Preparation Activities Implemented</i>	<i>GEF/LDCF/SCCF Amount (\$)</i>		
	<i>Budgeted Amount</i>	<i>Amount Spent To date</i>	<i>Amount Committed</i>
Consultancy	91,350	70,000	91,350
Stakeholders meetings	3,000	3,000	3,000
Field visit	2,000	2,000	2,000
Validation meeting	3,650	3,650	3,650
<b>Total</b>	100,000	78,650	100,000

<sup>22</sup> If at CEO Endorsement, the PPG activities have not been completed and there is a balance of unspent fund, Agencies can continue to undertake the activities up to one year of project start. No later than one year from start of project implementation, Agencies should report this table to the GEF Secretariat on the completion of PPG activities and the amount spent for the activities. Agencies should also report closing of PPG to Trustee in its Quarterly Report.

**Annex D: calendar of expected reflows (if non-grant instrument is used)**

Provide a calendar of expected reflows to the GEF/LDCF/SCCF Trust Funds or to your Agency (and/or revolving fund that will be set up)

**Not Applicable**



## **Annex E: List of Abbreviations**

AfT	Agenda for Transformation
BoS	Bureau of Standards
CLSG	Cote D'Ivoire, Liberia, Sierra Leone & Guinea Interconnection project
EESL	Energy Efficiency Services Limited, India
EPA	Environment Protection Agency
GEF	Global Environment Facility
GEFTF	GEF Trust Fund
GHG	Greenhouse gas
IPMVP	International Performance Measurement and Verification Protocol
LEAP	Liberia Energy Access Project
LEC	Liberia Electricity Corporation
LED	Light Emitting Diode
M&E	Monitoring and Evaluation
M&V	Monitoring and Verification
MDG	Millenium Development Goals
MLME	Ministry of Lands, Mines and Energy
MOCI	Ministry of Commerce and Industry
MOFD	Ministry of Finance and Development
MRV	Measurement, Reporting and Verification
NAPA	National Adaptation Programme of Action
NCCS	National Climate Change Secretariat
NPD	National Project Director
PIC	Project Implementation Committee
PIF	Project Information Form
PM	Project Manager
PMC	Project Management Cost
PMU	Project Management Unit
PPG	Project Preparation Grant
RC	Regional Coordinator
RIA	Roberts International Airport
RMU	Regional Management Unit
RREA	Rural and Renewable Energy Agency

## **Annex F: Country profile – Liberia**

### **Country profile and governance structure**

Liberia, officially The Republic of Liberia, is a coastal country situated in the western coast of Africa. It is bordered by Sierra Leone to its west, Guinea to its north and Ivory Coast to its east. The southern part of the country touches the Atlantic Ocean. It has a total area of 111,369 sq. km (land area of 99,067 sq. km) and had a population of 4.5 million in 2015<sup>23</sup>. About 49.5 % of the population lives in urban areas. Although there are about 29 different African languages belonging to the Mande, Kwa or Mel linguistic groups spoken in Liberia, its official language is English.<sup>24</sup> The official and primary currency of Liberia is the Liberian Dollar (LRD).<sup>25</sup> Use of the US Dollar is prevalent in the country.

The climate is tropical and humid, with slight variation in temperature throughout the year. The temperature ranges from 20° C in winters to 36° C in summers, with the average equal to 27° C. On the coast the heat is tempered by an almost constant breeze. There are distinct wet and dry seasons, most of the rainfall occurring between late April and mid-November.<sup>26</sup>

Liberia's governance model is based on the American model of a republic, wherein there are 3 equal branches of government and the President is the Head of State and the Head of Government. However, Liberia is a unitary state and has a multi-party system as opposed to being a federation and having a two-party system as in the US. Executive power is exercised by the government. Legislative power is vested in both the government and the two chambers of the legislature.

Liberia's highest judicial authority is the Supreme Court, made up of five members and headed by the Chief Justice of Liberia. Members are nominated to the court by the president and are confirmed by the Senate, serving until the age of 70. An informal system of traditional courts still exists within the rural areas of the country, with trial by ordeal remaining common despite being officially outlawed.

At present, there are **18 Ministries and five agencies** currently operating under President Sirleaf's cabinet, which are listed below:

- Ministry of Lands, Mines and Energy (MLME)
- Ministry of Commerce and Industry (MOCI)
- Ministry of Finance and Development Planning
- Ministry of State
- Ministry of National Defense
- Ministry of Justice
- Ministry of Agriculture
- Ministry of Youth and Sports
- Ministry of Foreign Affairs
- Ministry of Information Cultural Affairs and Tourism

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<sup>23</sup> Source: [The World Bank](#), accessed on 16 December 2016

<sup>24</sup> Source: [BBC](#), accessed on 16 December 2016

<sup>25</sup> 1 LRD = 0.011 USD, checked on 16 December 2016

<sup>26</sup> Source: <http://www.nationsencyclopedia.com/Africa/Liberia-CLIMATE.html>, accessed on 16 December 2016

- Ministry of Health
- Ministry of Gender, Children & Social Protection
- Ministry of Internal Affairs
- Ministry of Post & Telecommunication
- Ministry of Education
- Ministry of Labor
- Ministry of Public Works
- Ministry State without Portfolio
- Rural Renewal Energy Agency
- Environmental Protection Agency
- Civil Service Agency ( Ministerial Level)
- General Service Agency (Ministerial level)
- Forestry Development Authority
- Public Procurement & Concession Commission

Each ministry is responsible for development and regulation of their respective fields. The responsibility of development of the energy sector in Liberia lies with the Ministry of Lands, Mines and Energy (MLME).

The role of the Ministry of Commerce and Industry (MOCI) includes: Establishing and regulating commodity and trade standards; Collecting, evaluating, and publishing data pertaining to Commerce and Industry; Establishing and enforcing standards for business practices; Promoting sound development of foreign and domestic trade; Issue Import and Export Permits; Control quality of goods and commodity imported into and exported from the Country; Implement efficient and effective trade management system; and Monitoring and regulating prices of essential goods.

The Environmental Protection Agency, particularly the National Climate Change Secretariat (NCCS) is the clearinghouse on all climate change related matter in the Liberia, including mainstreaming of clean energy and promoting the use alternative energy sources.

### **Administrative structure**

Liberia is divided into fifteen counties, which, in turn, are subdivided into a total of 90 districts and further subdivided into clans. The fifteen counties are administered by superintendents appointed by the president. Nimba is the largest county by size at 11,551 sq. km, while Montserrado county, in which lies the capital city of Monrovia, is the smallest at 1,909 sq. km.

Although Monrovia is located in the Montserrado County, it is administered separately. Monrovia City Corporation runs many services inside the city. Being the capital city, Monrovia is the country's financial and economic hub, and attracts population from all over the country in search of employment opportunities. The city also host to all the government ministries and institutional bodies, and is the *de facto* political hub of Liberia.

## **Liberia's economic situation and development agenda**

In 2011, the country's nominal GDP was US\$1.154 billion, while nominal GDP per capita stood at US\$297, the third-lowest in the world. Historically, the Liberian economy has depended heavily on foreign aid, foreign direct investment and exports of natural resources such as iron ore, rubber and timber.

The Liberian economy was growing at a steady rate until 1980, when a period of economic mismanagement began. This decline was accelerated by the outbreak of civil war in 1989, which lasted for a period of 14 years till 2003. The civil war and political uncertainty has left the Liberian economy in shambles, with Liberia experiencing a decline of an estimated 90% between 1989 and 1995. Since the end of the war, the GDP has experienced a steady growth of 7%, reaching 2.106 billion USD in 2016.

The Liberian economy had relied heavily on the mining of iron ore prior to the civil war. Liberia was a major exporter of iron ore on the world market. In the 1970s and 1980s, iron mining accounted for more than half of Liberia's export earnings. However, since 1980, the country's economic growth rate has slowed down because of a decline in the demand for iron ore on the world market and political upheavals in Liberia.

The Liberian economy is in a fragile state as a result of the war and the government relies heavily on foreign assistance for its activities. It is estimated that 76% of the population has an income of less than USD 1 per day and 52% less than USD 0.5 per day. However, since 2003, Liberia has been on the path of recovery and has made substantial progress in development and reconstruction of infrastructure, especially roadways, generation, transmission and distribution. Since 2006, Liberia has made substantial progress in recovering from the 14-year civil war. **Between 2009 and 2013, the economy grew steadily at an average rate of 7.3 percent per year.** Liberia made notable progress in the reduction of poverty, development of infrastructure and restoring core sectors for economic growth.

Liberia has rolled out several policies that set ambitious targets for the medium and long terms. These policies are spread out across many sectors, which include energy, industry, poverty reduction, gender equality, exports, tourism, food, agriculture etc. Liberia rolled out a Poverty Reduction Strategy (PRS) that both fueled growth in the traditional economic sectors and had the goal of creating the foundations for sustainable and inclusive growth.

The first PRS sought to achieve specific objectives in four broad areas: Expanding peace and security; revitalizing the economy; strengthening governance and the rule of law; and rehabilitating infrastructure and delivering basic services. Liberia has made significant achievements in each of these areas, on which the current Agenda for Transformation (2012-2017) shall build on.

Liberia has also rolled out a **National Climate Change policy** to protect the environment and established the Environmental Protection Agency (EPA) to oversee the regulation.

## **Annex G: Pilot program execution methodology**

This section describes the working mechanism of the pilot program - the program location, target consumers, working procedure, stakeholders involved, cost analysis etc.

### **A) OBJECTIVE OF PILOT PROGRAM AND TARGETED LOCATIONS**

The pilot project aims to distribute efficient 6W LED bulbs (2 per household) to 40,000 households (connections) in exchange for existing incandescent bulbs to reduce the GHG emissions intensity of the residential sector in the project areas, and increase public awareness on energy efficient technology. **The project will be conducted in the same locations as those of the baseline project, LEAP.**

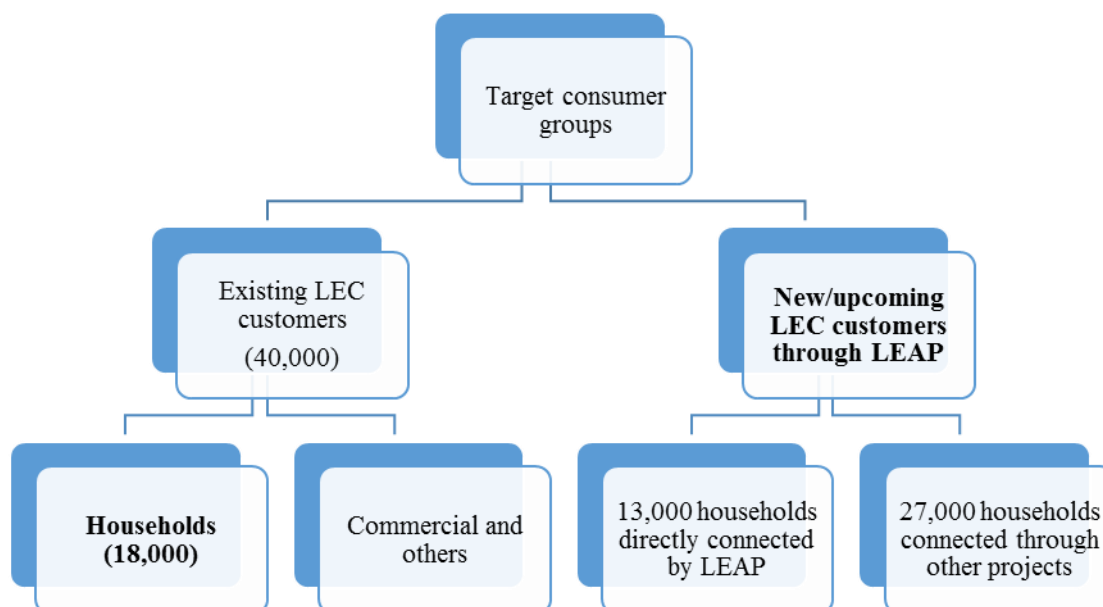
The project locations are:

1. **The Monrovia - RIA corridor** – The LEAP project involves construction of transmission and distribution lines, and substations across the Monrovia – RIA corridor over a distance of approximately 46 km. New connections will be provided from Paynesville through Schiefflin to the Roberts International Airport.
2. **Pleebo - Fish Town corridor** - The Pleebo-Fish Town corridor will involve the construction of transmission and distribution lines and substations from Pleebo (Maryland County) to Fish Town (River Gee County) in south-eastern Liberia. This will cover a distance of approximately 100 km across 19 towns.

### **B) TARGET CONSUMERS**

Since this is the first such program in the country under the domain of energy efficiency, it is advisable to target only households that are or will be connected to the LEC network in the project locations.

An illustrative segregation of the households with active grid connection at present and the household which are expected to get connected in near future is described below:



From the figure the target consumers can be defined in following manner:

- First and foremost are the **13,000 households** that shall be connected to grid electricity through the LEAP project directly. These households shall be included in the target consumer group.
- There are three strategies proposed for the remaining 27,000 households to be covered. These are tabulated below:

Strategy A	Strategy B	Strategy C
<ul style="list-style-type: none"> <li>✓ Include the 18,000 households in the target consumer group which are already connected to LEC network in Monrovia.</li> <li>✓ The remaining 9,000 consumers can comprise of <b>commercial</b> sector consumers which are also already connected to LEC network.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Include the 18,000 households in the target consumer group which are already connected to LEC network in Monrovia.</li> <li>✓ The remaining 9,000 household consumers can be considered based on other ongoing programs in the country.</li> </ul>	<ul style="list-style-type: none"> <li>✓ Include the 27,000 households in the target consumer group which can be considered based on other ongoing programs in the country.</li> </ul>

It is proposed that amongst the above mentioned strategies, the most appropriate target group of consumers shall be selected by LEC in consultation with stakeholders such as AfDB, MLME and NCCS. The LEC shall select the strategy with the viewpoint enrolling a wider set of consumers under the pilot program.

### C) SEGREGATION OF CONSUMERS W.R.T LED BULB DISTRIBUTION STRATEGY

The target consumers in the project areas have been classified into two groups for bulb distribution. The strategy and mode of LED bulb distribution is different for these two consumer groups:

- **Existing consumers** - Consumers already connected to the LEC network at the time of the pilot program.
- **New consumers** - Consumers that shall be connected to the LEC network as a part of the LEAP program

**Group 1: Existing LEC consumers:** This group consists of those consumers in the project areas that are already connected to the LEC network at the time of execution of LEAP project. Consumers belonging to this group are mostly located in Monrovia and the Greater Monrovia Region, since LEC is only present in these areas.

From the previous section, **it is estimated that this customer base shall comprise of connections mentioned in Strategy A and Strategy B.** These connections will be targeted under the pilot project from this group.

Since consumers in this group are already served by the LEC, they must already have an existing lighting demand. It is assumed that this lighting demand met by use of incandescent bulbs (as per PIF) of rating 60W. Therefore, for this consumer group, **LED bulbs will be offered to households in exchange for incandescent**

**bulbs.** The exchange will be conducted when these consumers when they visit the LEC offices for payment of electricity bill. The number of LEDs distributed to each household will be limited to two. The reduction in energy consumed can be quantified since actual reduction in energy demand is taking place. The deemed savings model shall be followed.

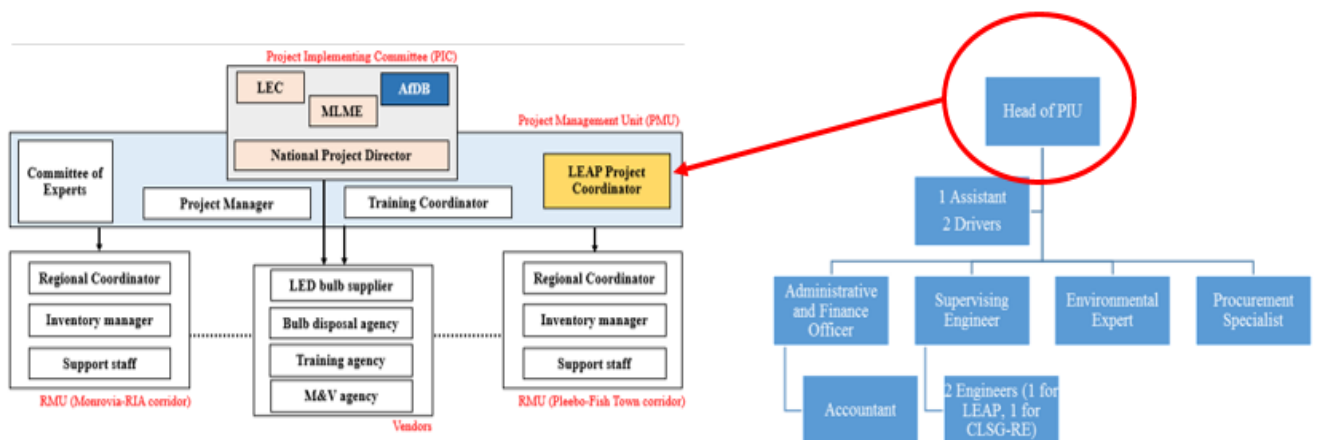
**Group 2: New consumers:** This group consists of those consumers in the project areas that are not connected to the LEC network at the time of execution of LEAP project, but will be connected as a part of the LEAP project. These consumers may or may not be served by IPPs or generators. **For the pilot project, 13,000 household connections will be targeted from this group.**

Since consumers in this group may not have an electricity connection, **two LED bulbs will be provided to each household free of charge** at the time of registering for an electricity connection. Because no direct exchange is taking place in this distribution model, the energy reduction achieved will be based on the deemed savings model. It is assumed that these consumers would have purchased incandescent bulbs had the pilot program not taken place.

#### D) INSTITUTIONAL ARRANGEMENT FOR PROGRAM EXECUTION

The implementation of all three components proposed under GEF financed project is proposed to be overlooked by a three-tier set of committees. These committees will be formed – the Project Steering Committee (PSC), the Project Implementation Committee (PIC) and two regional Project Management Units (PMU). The detailed description of roles & responsibilities as well as their constitution is provided in section A6 ‘Institutional Arrangement and Coordination’.

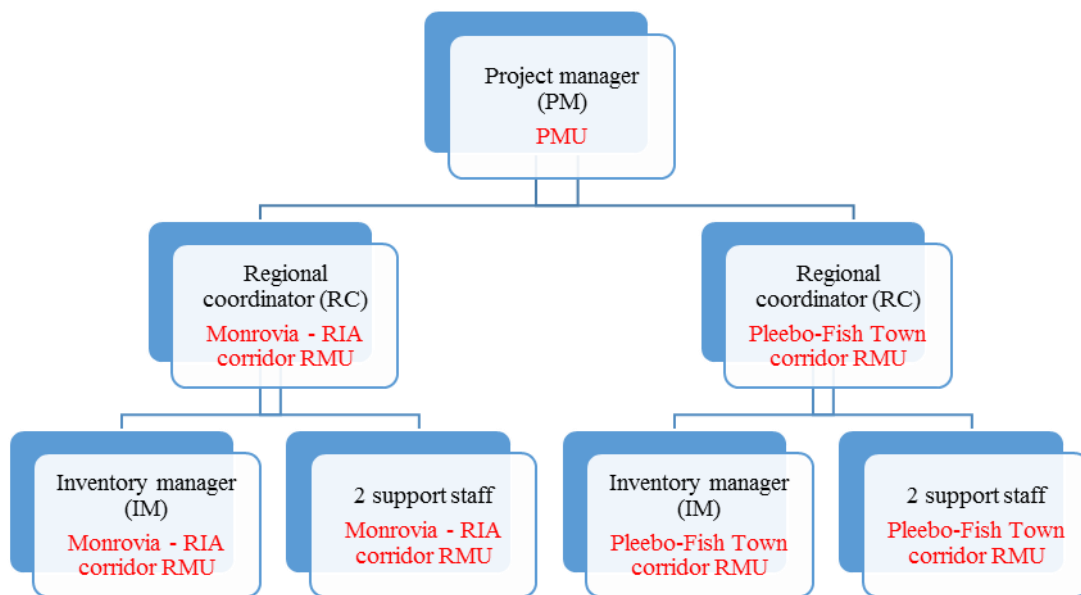
The pilot project under component 2 will **run in tandem with the baseline LEAP project.** The PIU within LEC, which is responsible for implementing the AfDB financed Rural Electrification Component of CLSG project, is also responsible for implementation of the LEAP project. The **implementing agency for the pilot program will also be LEC** and hence there is a strong need for establishing effective coordination mechanism between the existing PIU within LEC and the proposed PIC and PMUs under the GEF financed project. The organization structure of the existing PIU as well as the coordination arrangement under the proposed project is as shown below:



The pilot program under the GEF financed project will be conducted **simultaneously** with provision of electricity supply connections in areas covered under the Monrovia-RIA corridor and the Pleebo-Fish Town corridor. Since the two project sites are located very far apart, it is proposed that two separate Regional Management Units (RMUs) will be established under the overall Project Management Unit (PMU) for distribution of LED bulbs and collection of incandescent bulbs. The RMUs will be established by LEC.

Each RMU will be staffed with a Regional Coordinator (RC) who will be responsible for overall management of the distribution in the respective project area. The RC will coordinate with different stakeholders to arrange LED bulb stock at the LEC office on the day of the distribution and oversee the distribution process. The RC will report to the Project Manager (PM) in the PMU and provide daily progress reports and stock updates.

The RMUs will also be staffed with one Inventory Manager (IM) and two support staff for on-ground execution of the pilot program. They will report to the RC and work under the RC’s guidance and supervision. The IM will ensure real time inventory management of LED bulbs in the local warehouses and timely transportation of LED bulbs to LEC offices. The support staff will carry out the LED distribution and incandescent bulb collection at the LEC office.



The PM in the PMU will be assisted by a team of experts, which include a **procurement specialist, an administration and finance specialist and an environment expert**. The procurement specialist in the LEAP PIU will serve as the procurement specialist in the PMU for the GEF-financed project as well. The team of experts will support the PM in all procurement, quality control, M&V and accounting activities.

**E) WORKING MODEL FOR DISTRIBUTION OF LED BULBS**

The working model for LED bulb distribution is slightly different for the two consumers groups, because existing LEC customers are offered LED bulbs on exchange with incandescent lamps, whereas new LEC customers are offered LED bulbs free of charge. Therefore, the working model for the former will involve storage and safe disposal of collected incandescent bulbs in addition to all activities involved for the latter group. The exact working of the program is described below:



## **Step 1: Defining standards and specification for LED bulbs & development of tender documents**

The RMU within LEC in consultation with PMU and relevant stakeholders shall define the LED bulb standards and minimum technical specifications. Also, taking reference from AfDB standard procurement rules, tender documents shall be prepared for inviting proposals from LED bulbs vendors.

A detailed description of LED bulb technical specifications and international reference standards are provided in ‘**Annex H: LED technology and specifications**’ of this document. During the implementation phase these specifications shall be reviewed and finalised for procurement of LED bulbs.

## **Step 2: Engagement with LED bulb supplier, procurement of LED bulbs and arrangement of local warehouses**

The supply of LED bulbs of required specifications and in the required quantities shall be taken care by the Procurement Officer in the PIU within the LEC in coordination with AfDB and MLME. The hiring of the LED bulb supplier shall be conducted in accordance to AfDB’s standard procurement procedure and practices. The LEC and its procurement officer shall ensure that multiple bids are invited for supply of LED bulbs in the project location so as to arrive at the competitive prices for the bulbs of a defined technical specification. The appointment of LED bulb supplier and complete procurement schedule shall be taken care by PIU under LEC.

The LED bulb supplier shall be required to supply the LED bulbs as per the following schedule template. The LED bulbs supplier and LEC shall coordinate with MLME to get the necessary approvals from the Government of Liberia and Customs for ensuring timely supply.

<b>S. No.</b>	<b>Project location</b>	<b>Quantity of LED bulbs</b>	<b>Date of delivery</b>
1	Monrovia	20,000	
2	Fish Town	3,000	
3	...	...	
4	...	...	

The Procurement Officer in the PIU shall also acquire local warehouses in each project location. These warehouses shall be utilised for storage of LED bulbs received from the supplier and incandescent bulbs collected from consumers. The LED bulb supplier shall supply the LED bulbs at these local warehouses in the respective project areas as per the above-mentioned timelines. The cost of transportation of LED bulbs to the warehouses shall be borne by the LED bulb supplier.

Inventory management shall be conducted in the local warehouses on a daily basis. Any inclusion and removal of LED bulbs/incandescent bulbs shall be duly noted in the following format. The LEC shall hire dedicated personnel (2 per warehouse) for this task.

<b>S. No.</b>	<b>Date</b>	<b>Time</b>	<b>Type of bulb</b>	<b>Add/ Remove</b>	<b>Quantity</b>	<b>Remarks</b>	<b>Sign</b>
1			LED	Add	5,000	Received from supplier	
2			LED	Remove	500	LED distribution	
3							
4							

**The LED bulb supplier shall also provide a performance guarantee for a period of 3 years.** Since it is not practical to replace the bulbs in case of defects, the supplier shall be required to provide a performance guarantee valid for the same duration to the PIU. In case of any defects, the cost of the bulb shall be deducted from the guarantee amount.

The contract with the LED bulb supplier shall also include a **warranty clause** which specifies the procedure to be followed if LED bulbs are found to be defective. In usual cases, the supplier is generally required to provide warranty and arrange for replacement of defective LED bulbs for a certain period (3 years usually).

### **Step 3: Awareness programs conducted and distribution counters set up**

Awareness programs shall be conducted in the project areas prior to commencement of distribution in that area. The awareness programs shall include installation of banners/posters in public locations, pamphlets across the project areas, posters in all LEC offices and project sites, advertisements through radio channels etc., and other general public outreach activities. These activities shall inform the public in the target areas of the project and raise participation. **LEC shall be responsible to conduct these awareness programs.**

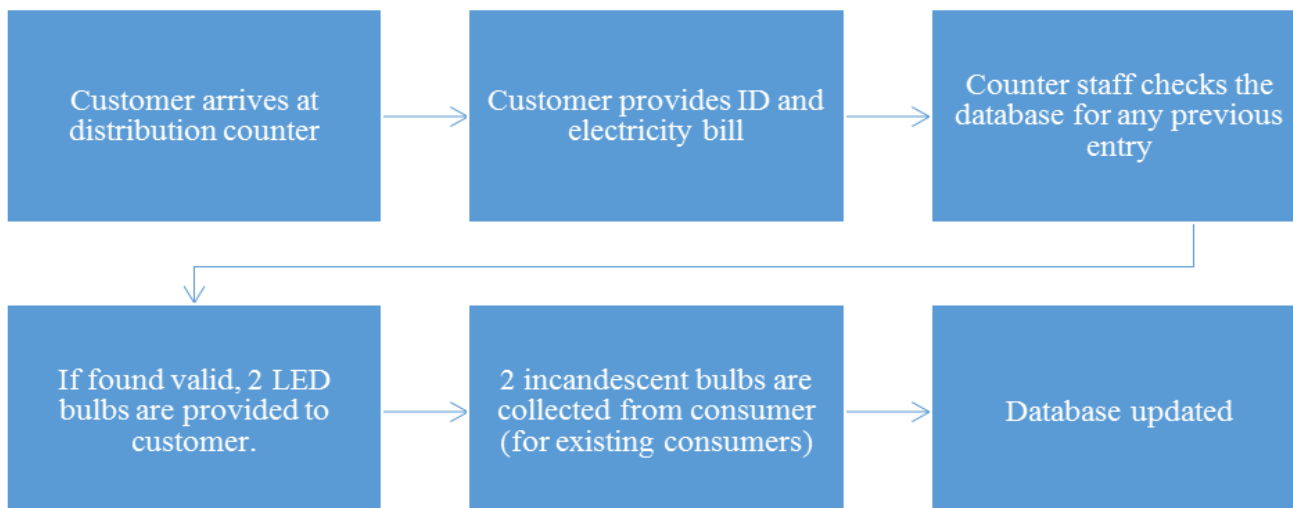
The activities involved in this task shall include:

1. Design of posters, pamphlets, banners and radio advertisement content
2. Distribution of posters, pamphlets and banners across project locations
3. Liaising with radio stations to broadcast advertisement

For distribution, special counters (#2) shall also be set up in the LEC offices in the project areas. These counters shall be dedicated to distribution of LED bulbs and collection of incandescent bulbs from consumers. These counters shall be equipped with infrastructure to maintain a directory to ensure that no consumer receives more than 2 LED bulbs. **LEC shall be responsible for setting up and running these counters.** Three persons shall be engaged by LEC to run these counters, maintain database and coordinate the transportation of LED bulbs/incandescent bulbs to/from the local warehouses.

### **Step 4: Distribution of LED bulbs**

The dedicated counters set up at the project locations shall facilitate the distribution of LED bulbs to consumers. LED bulbs shall be distributed when customers arrive at the LEC office for either registering for a new connection or paying the electricity bill. The distribution process shall take place in the following manner:



A detailed database will be maintained by the counter staff to ensure that no consumer is provided more than 2 LED bulbs. Also, the data collected will be used for MRV in Step 6. The database will follow the following format:

S. No.	Date & Time	Name	Address	Connection number	Number of LED bulbs distributed	Number of Incandescent bulbs collected
1						
2						

**Also, the distribution team from the supplier shall arrange transportation of LED bulbs from the local warehouse to the LEC office every morning, and unused LED bulbs & collected incandescent bulbs from LEC office to the local warehouse every evening.**

### Step 5: Disposal of incandescent bulbs

In the process of replacement of incandescent bulbs with the new LED lights, there is a possibility of generation of hazardous waste due to the presence of toxic material inside the bulbs. Incandescent bulbs might contain lead. The toxic material present inside the luminaire has the potential to contaminate environment and cause serious health impacts to the people coming in its contact.

Once the proposed program at the defined project location is complete, the safe disposal of incandescent bulbs collected in exchange for LED bulbs shall be arranged. The used incandescent lamps would essentially need to be stored safely and disposed off in a controlled environment.

Therefore, the following steps will be followed to ensure safe disposal of used lighting:

- At the warehouse a designated area shall be allocated for storing hazardous materials, and segregation between damaged and undamaged luminaries. Adequate personal protective equipment shall be provided to the workers engaged in the collection, storage, loading and unloading work to prevent the exposure of workers with the toxic materials. The warehouse shall have adequate ventilation arrangement to prevent the accumulation of toxic gases from the damaged bulbs

- A thorough review of the **internationally accepted guidelines for safe disposal of lighting equipment** shall be done. Also, review of **procedures adopted in other ECOWAS countries** for safe disposal of hazardous material and the standard guidelines from AfDB on disposal of electrical luminaries shall be done. Based on the review of internationally accepted guidelines, a mechanism for disposal of incandescent bulbs shall be defined for the proposed project.
- The agency for safe disposal of collected bulbs shall be empanelled.

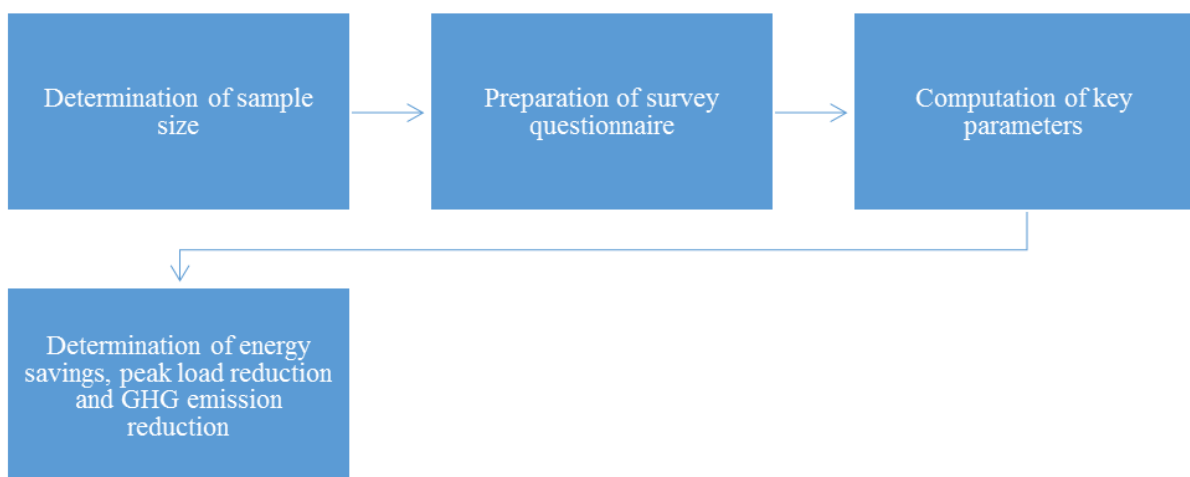
The empanelment shall be done in accordance with AfDB’s standard procurement guidelines and practices. **The execution of disposal work shall be managed by LEC.**

### Step 6: Measurement, reporting and verification (MRV)

MRV of the pilot project will be conducted using IPVMP’s **“Individual ECM – deemed savings approach”**. The deemed savings approach, is most suitable to the proposed energy efficiency lighting project. The program’s limited scale, established technology, and assured savings makes this approach the most suitable.

The following activities will be carried out during the MRV process:

- Estimating the project specific sample size for achieving 80% confidence level and 10% margin of error.
- Preparation of questionnaire for field survey. The questionnaire shall capture data for evaluation of number of LED bulbs installed in a given sample size in following state:
  - ✓ LED bulbs which are in-use
  - ✓ LED bulbs which have malfunctioned
  - ✓ LED bulbs which have not been installed yet and are therefore non-operational at the time of survey
- Based on field survey estimating the total energy savings by following deemed saving approach. Based on the analysis, verifying the initial estimated savings from the project during inception stage.
- Defining the energy saving calculation method
- Defining the GHG emission calculations



**Determination of sample size:** Since the energy efficiency measure will be implemented in various households, carrying out surveys of the entire project size would not be cost as well as time & resource efficient. Therefore, a sample size must be selected that would reasonably represent the entire sample space. The sample sizes decided for the survey shall be based on 80% confidence level and 10% margin of error.

**Preparation of survey questionnaire:** The survey questionnaire shall be prepared such that all the important parameters required for calculation of savings are captured in the survey. A few important parameters include:

- Number of LED bulbs installed
- LED bulbs which are in-use
- LED bulbs which have malfunctioned
- LED bulbs which have not been installed yet and are therefore non-operational at the time of survey
- Number of operating hours
- Number of days of use in one year

The data collected from the survey shall be tabulated as under:

S. No.	Power consumption of LED bulb (W)	Total number of LED bulbs installed (A)	Number of LED bulbs not operational (B)	Number of LED bulbs kept for future use (C)	Number of defective LED bulbs (D)
1					
2					
3					

The results of the questionnaire will be extrapolated to account for the number of LED bulbs in working condition.

**Computation of key parameters:** Based on the findings of the survey, the actual energy savings accrued due to the installation of LED bulbs will be calculated in terms of *estimated energy savings* in million units/annum, *avoided peak load reduction* in MW and *reduction in GHG emissions* in tons of CO<sub>2</sub> (tCO<sub>2</sub>).

**Energy savings:** The formula to be used to calculate energy savings in the deemed approach is shown below:

$$\text{Energy savings} = \text{Baseline Consumption} - \text{Consumption post project implementation}$$

The baseline consumption is calculated as the energy consumption by the system before project implementation. While calculating the baseline savings, the consumption of the system where LED bulbs been kept for future use has not been considered.

$$\text{Baseline consumption} = (\text{Number of LED bulbs distributed} - \text{LED bulbs kept for future use by the residents}) \times \text{Wattage of incandescent bulbs} \times \text{Hours of operation}$$

The deemed saving model considers that assumptions related with baseline consumption such as wattage of incandescent bulb and usage pattern needs to be agreed between the stakeholders during the project implementation.

Consumption post implementation has been computed for the LED bulbs found operational. Additionally, for the LED bulbs found to be defective, it is assumed that the consumers have moved back to using the incandescent bulb

*Consumption post project implementation = [(Number of LED bulbs operational x Wattage of LED bulb) + (Number of LED bulb found defective x Wattage of incandescent bulb)] x Hours of operation*

## F) SUMMARY

<b>Parameter</b>	<b>Description</b>	<b>Programme details</b>
<b>Project location</b>	The areas which shall be covered under the pilot demonstration.	The pilot project shall be limited to that of the LEAP project. The project area includes: <ul style="list-style-type: none"> <li>• RIA corridor</li> <li>• Pleebo-Fish Town Corridor</li> </ul>
<b>Target consumer segments</b>	The households to whom the LED bulbs will be distributed.	The pilot project will be limited to two consumer segments: <ul style="list-style-type: none"> <li>• New consumers that would be connected to the LEC network through the LEAP project (13,000 households in project areas)</li> <li>• Existing consumers currently being served by LEC (as per Strategy A or B or C)</li> </ul> Consumers served by IPPs and independent generators will be targeted in future programs
<b>Executing agency</b>	The agency responsible for carrying out/execution of the program	LEC
<b>Bulb distribution scheme</b>	Working model for distribution of LED bulbs	The LEDs will be distributed free of charge to the households in exchange for incandescent bulbs. In case, the consumers in selected areas doesn't have the ICLs, then also the LED bulbs will be distributed free of charge. The number of LEDs distributed per household will be limited to 2.
<b>Working mechanism</b>	The process adopted for distribution of bulbs.	The LED bulbs will be distributed through the LEC office, during the implementation of LEAP. <ul style="list-style-type: none"> <li>• Those consumers that would be connected to LEC would be targeted when they come to LEC office to get a new connection.</li> <li>• Existing consumers of LEC would be targeted when they come to LEC office to pay their electricity bill.</li> </ul>
<b>Project timelines</b>	The overall timeline for the execution of the project. This depends on the project location, the working mechanism adopted and efficiency of executing agencies.	Because the GEF funded project is intended to be run in tandem with the LEAP project, the timelines will also be similar.
<b>Vendors involved</b>	The different vendors involved in project execution.	2. LED bulb supplier 3. Media and awareness agency 4. Bulb disposal agency (for incandescent bulbs)

## **Annex H: LED technology & specifications**

First created in 1927, the LED<sup>27</sup> is a 2 lead semiconductor light source which emits light when voltage is applied across the leads through the process of electroluminescence. Subsequent advancement in semiconductor technologies, optics and material science, resulted in an exponential increase in the light output of LEDs. This led to development of LED lamps and luminaries which can be packaged into commercial products and be used for general illumination purposes. **The advantage of the LED bulb lies in its incredibly low power consumption. A typical LED bulb's rated power lies in between 6W to 9W, compared to 45W to 60W as that of an incandescent bulb.**

### **Components of LED bulb**

A conventional LED lamp has 6 main components:

1. **Base:** It serves as the entry electrical power. There are multiple types based on the design and diameter of the base.
2. **Electrical Connector:** It serves as a housing for the connecting components of the driver and base.
3. **Driver:** The driver converts AC power supplied by the fixture into 12 volt DC current to run the LEDs. During the process of conversion, some heat is generated which affects the longevity of the bulb. In most cases it integrates electrical ballast which regulates current and provides sufficient voltage to start a lamp.
4. **Heatsink:** The primary purpose of this component is to dissipate the heat generated by the driver, thereby increasing the bulb longevity. Usually, it is constructed of aluminium fins.
5. **LED Panel/Module:** It is the circuit board that contains the array of LEDs producing light. The board may hold as few as one LED or an array of 10 or more LEDs.
6. **Globe/Lens:** Typically made of plastic, it is designed to diffuse the light produced by the LED module. The structure of the globe determines the dispersion of light.

### **Internationally accepted test standards for LED**

#### **LM 79-08**

The default global test standard is LM 79-08 developed by Illuminating Engineering Society of North America (IESNA). It provides the environmental conditions for testing, how to operate and stabilize LED sources during testing, the methods of measurements and type of instruments to be used. It captures aspects of performance which includes photometric and electrical properties. The photometric properties include the following:

1. Luminous flux
2. Luminous efficacy
3. Luminous Intensity Distribution

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<sup>27</sup> LED – Light Emitting Diode

4. Chromaticity Coordinates
5. CCT
6. CRI

#### CIE S 025/E:2015

Since IESNA LM79-08 was developed by a regional organization, many national standards could not adopt this. Hence in March 2015, CIE S 025/E:2015 was published by International Commission on Illumination or Commission Internationale de l'Eclairage (CIE) based on global representation. CIE S025 draws on experience of LM-79 and is more comprehensive, covers more measurement instruments and has greater depth. It covers measurement of:

1. Total luminous flux
2. Partial luminous flux (useful lumens)
3. Centre beam and beam angles
4. Electrical measurements
5. Luminous efficacy (efficiency)
6. Luminous intensity distribution
7. Chromaticity coordinates
8. CCT
9. Distance from Planckian locus
10. CRI
11. Angular colour uniformity

It also specifies standard test conditions and also accounts for uncertainty of instrument measurement by specifying tolerance interval and acceptance interval.

#### In Situ Temperature Measurement Test (ISTMT)

It is the measure of the LED source temperature within the LED system. It is used to check whether the temperature of the luminaire is within the temperature of the LM 80-08 report and it forms the basis for determination of LED lifetime based on TM 21-11 or any other method.

#### LM 80-08

Developed by IESNA it is used to measure lumen maintenance of LED light sources. The report provides luminous flux for a given current over a 6000 hour period. It is conducted for 3 different LED case temperatures: 55°C, 85°C and a 3<sup>rd</sup> temperature selected by the manufacturer.



### TM 21-11

TM 21-11 is the approved method by IESNA for taking LM-80 data and make useful lifetime projections for LED luminaries.

### **Illustrative accepted specifications of LED bulbs**

<b>Sr. No.</b>	<b>Parameters</b>	<b>Requirements</b>
1.	Light source	SMD LED chip
2.	Lamp Wattage	Up-to 8 W ( Suitable to replace 60 W ICL)
3.	CCT	Warm white (2700K) or Cool white (5700K)
4.	LED Chip Wattage	< 1w
5.	Base Cap	B22d (Bayonet Cap)
6.	Ingress Protection	IP20
7.	Rated Luminous Flux	500 Lumens Minimum
8.	Lamp Efficacy (lm/w)	Minimum 70
9.	CRI	Minimum 80
10.	Beam angle (Typical Value)	120°
11.	Junction temp	Maximum 85°C
12.	LED Chip Efficacy	Minimum 115 Lm/W
13.	Harmonics	Maximum 20%
14.	EMC	Table 6 and 7
15.	Lumen Maintenance @ 85°C	Minimum 70% up to 25000 hrs.( Indoor application)
16.	PF	Minimum 0.9
17.	Life Hours	Minimum 25,000
18.	Rated Voltage	100 V – 300 V
19.	Surge Voltage	> 2.5 kV
20.	Working Temp	-10 to 50 deg C
21.	Working Humidity	10% - 90% RH
22.	Safety Requirement	All Test
23.	Driver Efficiency	>85%
24.	Temperature Cycling test and supply voltage switching test	Product shall be subjected to the following for 5 cycles: 10 °C for 1 hrs. 50 °C for 1 hrs. 30 Sec On and 30sec Off. At the end of test as per (1) and (2) no visual damage shall be observed and lamp shall alight for more than 15 min after test.
25.	Accelerated operational life test.	Product shall be operated continuously for 6000 hours. Test has to conduct at 45°C At the end of test, no visual damage shall be observed and lamp shall alight for more than 15 min after test.

## **Annex I: An international case study: UJALA scheme in India**

The organization, Energy Efficiency Services Limited (EESL), is implementing the UJALA (Unnat Jyoti by Affordable LEDs for All) program in India. The EESL is a Public Sector Undertaking company under Ministry of Power, Government of India, for implementing various Demand Side Management (DSM) programs. EESL is leading the Energy Service Company (ESCO)-based energy efficiency programs particularly in the public facilities (residential, municipalities, buildings, agriculture, industry etc.) in the country. EESL is working as super ESCO, as Consultancy Organization, and as a Resource Centre for capacity building of utilities, financial institutions, commercial buildings, etc.

The EESL, conceptualized the idea of UJALA lighting program to promote LEDs in the Indian Residential sector. The ultimate purpose of the program is to reduce the cost of LED bulbs and achieve increased market penetration of LED bulbs in India, thus driving out inefficient incandescent lamps from the market.

In the baseline scenario for the residential sector in India, almost 28% of total residential energy consumption is contributed by lighting load, which is dominated by Incandescent Lamps (ICL). In fact, in 2012, ICL lamps comprised of approximately 60% of all lighting used in the residential sector in India. The same for efficient technologies like LED was as low as 1%. It was estimated that use of efficient lighting system such as ‘LED in place of ICLs’ can lead to national level intervention to enhance the efficiency of lighting sector by reducing the demand for electricity by over 50 billion kWh every year. This will be equivalent to an avoided capacity addition of about 19,000 MW.

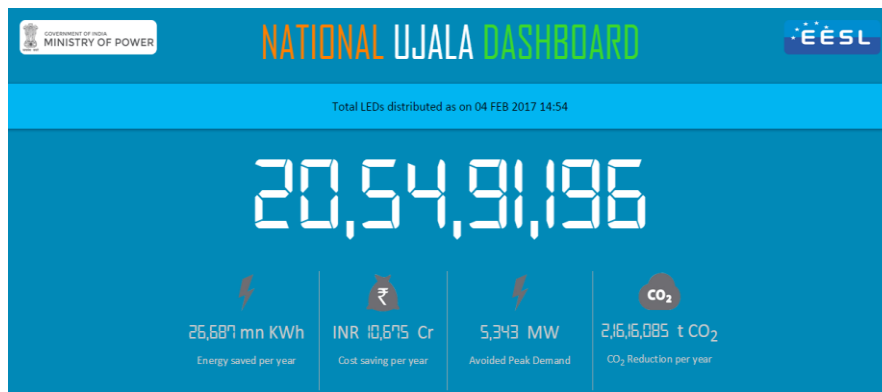
However, the most important barrier for uptake of LED lamps in the country *was* its high price when compared to other technologies, including ICL lamps. This was the main reason for restricted demand for the technology in India. To overcome this challenge, EESL adopted a demand aggregation strategy to reduce the effective price of LED bulbs through promotion of economy of scale. The EESL aggregated the demand from various parts of the country and procured large quantity of LED bulbs through an open tendering mechanism and selected the technically qualified bidder on least cost basis.

Through this strategy, the effective price of 7 W LED bulbs have reduced from USD 4.77 in Jan 2014 to USD 1.26 in Mar 2015. Recently, in Jan 2017 the prices have dropped further and at present it is approximately USD 1. Also, in the recent price reduction the EESL have introduced 9 W LED bulbs at the price.



Along with price reduction, EESL has adopted an innovative method called “On Bill Financing (OBF)”, in which consumers are provided LED bulbs at an upfront payment of USD 0.167 and the remaining amount is

deducted from their electricity bills over a span of 12 months on average. This has led to greater market acceptability of LED bulbs and have led to a complete market transformation of the lighting market in India.



At present (January 2017), EESL has managed to distribute **205 million LED bulbs** across the country, as shown in its real-time distribution count.

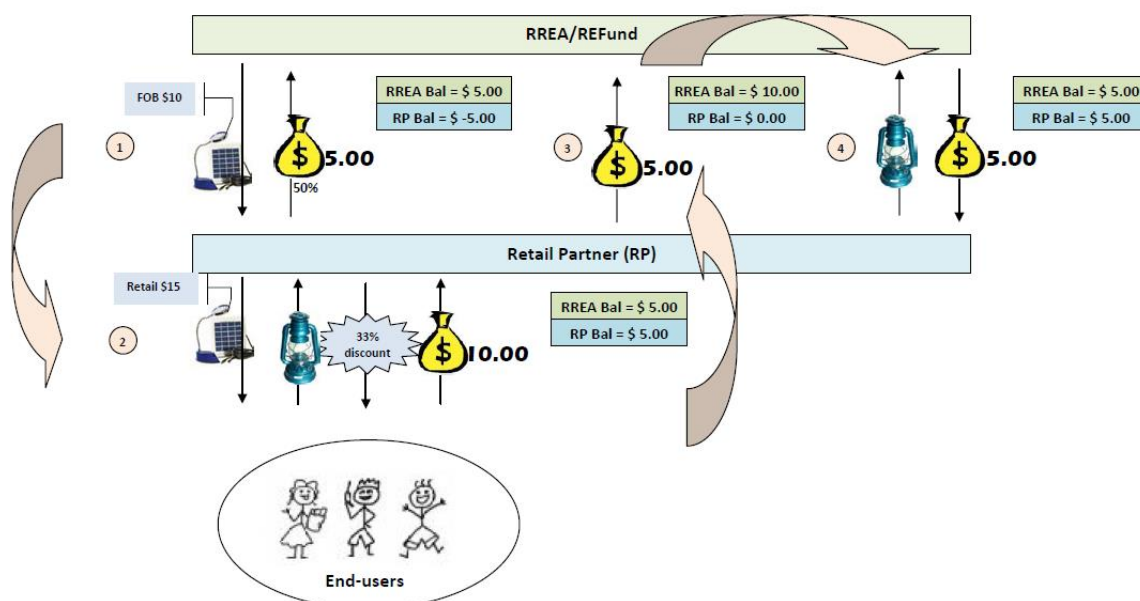
## **Annex J: Lighting Lives in Liberia (Solar lantern project)**

The Solar Lantern project is a GEF-financed project introduced in 2012. The implementing agency was RREA. The project introduced LED devices, which are powered by renewable sources (mainly solar power) into Liberia’s market for lighting products. The global environmental objective of this project was *to reduce greenhouse gas emissions when compared with Liberia's emissions growth baseline*, and thus to contribute to mitigating climate change.

The project introduced the lantern exchange program to promote off-grid lights in local markets, which included commercial marketing and sales of about 100,000 solar lights while removing an equal number of polluting and low-quality lanterns and products (including disposable battery-powered lights and kerosene) from household use. The GEF grant effectively created a revolving working capital fund, utilizing incoming payments from retail partners to import additional products and further support the expansion of the market.

The lantern sales were enabled through the following mechanisms: (i) subsidizing the import of the products, so that they can be sold at wholesale cost. Subsidies was expected to be phased out during the program to ensure full commercial sustainability by program’s end; (ii) provision of trade finance to vetted retailers, so that they can afford to enter the off-grid lighting market in the absence of favorable lending terms from commercial banks; (iii) business support to these same retailers, in the areas of technical training and consumer outreach; (iv) consumer education on solar lighting products, the Lighting Africa program, and the availability of discounts for surrendered working kerosene or low-quality battery-powered lights; (v) putting the market entry risk on the public sector (RREA), so that products can enter Liberia’s market and consumers gain familiarity; and (vi) working with government stakeholders to improve the policy and regulatory environment to help lower the barriers to business development.

**Lantern exchange mechanism:** In order to remove the old lamps from the system and ensure that greenhouse gas emissions are de facto reduced, a lantern exchange program was envisaged. It was based on the notion that handing in a working kerosene lamp or battery-powered low-quality light will result in a discount for a new “Lighting Africa” approved solar light. Initially, a discount of between 25-33% was suggested. The mechanism for the lantern exchange is as follows:



- Retail partner picks up x number of solar lights, pays RREA x percentage of FOB cost.
- Retail partner sets retail price, makes sale; accepts working kerosene lamp from consumer, and sells solar light minus x percent of retail price in exchange.
- Retail partner returns the kerosene lamp to the RREA.
- RREA reimburses retailer for the amount of the exchange discount (x percent of retail price).
- Retailer retains original profit margin. RREA retains x amount to recycle into further purchases.

The experiences of RREA from this project would be highly useful in understanding the on-ground issues which preparing for pilot demonstration of LED bulbs under the proposed GEF project. The project management unit and LEC shall establish coordination with RREA to identify field requirements and learn from their experiences.

## **Annex K: List of stakeholders consulted during PPG**

National and sub-national organisations and institutions were consulted during the Project Preparation Grant (PPG). These organisations and institutions are listed below.

### **1. The Liberia Electricity Corporation (LEC)**

LEC is the national electricity company of Liberia which is responsible for the electricity generation, transmission and distribution in the country. LEC was revived in 2007 after being practically non-existent since the Civil wars. In 2010, a management contract was signed with Manitoba Hydro International (MHI) for 5 years to build up the electricity grid of Monrovia and to expand its customer base. It has since been renewed for one more year. The LEC is the executing entity for the LEAP project.

The LEC will oversee and conduct the pilot program in the project areas as mentioned in component 2 of the GEF financed project. It will also be in charge of procurement activities and hiring of key personnel.

However, it lacks the technical knowledge in the fields of energy efficiency measures and climate change mitigation measures. Through this project, employees of LEC will be imparted trainings to build technical capacity relevant to energy efficiency and climate change. LEC will receive additional support through energy efficiency audit of LEC's rural distribution network as well as study of the scope energy efficient appliances in the target areas.

### **2. The Ministry of Lands, Mines and Energy (MLME)**

The Ministry of Lands, Mines & Energy (MLME) was established by an act of Legislature to administer all activities related to land, mineral, water and energy resources exploration, coordination and development in the Republic of Liberia. The MLME shall play a pivotal role in all the existing activities and the future expansion plans for the project.

### **3. Department of Energy (DoE)**

The DoE is a department of MLME which is dedicated to the energy sector of Liberia. It facilitates the provision of energy to domestic, commercial and industrial users by public enterprises and the private sector by developing an efficient regulatory, planning and implementation framework. Being the nodal body for the energy sector in Liberia, DoE will be involved at all stages of the project.

Development of policies and legislations to phase out of incandescent lamps and incentive mechanisms to promote uptake of energy efficient appliances are specific areas where DoE shall play a key role.

### **4. The Rural and Renewable Energy and Agency (RREA)**

Established in early 2010, Rural and Renewable Energy and Agency (RREA) works to facilitate and accelerate the economic transformation of rural Liberia by promoting the commercial development and supply of modern energy products and services to rural areas through the private sector and community initiatives with an emphasis on locally available renewable sources. It manages the Rural Energy Fund (REFUND) which is the channel through which all domestic and international financial resources intended for rural energy delivery in Liberia are routed.

RREA plays a part in implementation of pilot program and developing incentive mechanisms aimed at improving uptake of energy efficient appliances in rural Liberia. The RREA will play an important role in planning and conducting the needs assessment workshop and public outreach program for energy efficient appliances. RREA's experience in execution of World Bank's solar lantern program in rural Liberia will also be instrumental in execution of the pilot program.

## **5. Rural Energy Service Companies (RESCOs)**

RESCOs include community-owned small electricity cooperatives, Regional Economic Communities (RECs), privately owned generation and distribution companies, and nongovernmental organization. RESCOs own the generation and power distribution equipment and provides an electricity service. They use 'Fee for service' model, where customers typically pay an installation or connection fee plus an electricity tariff. RESCOs, thus provide a potential to provide electricity to those areas where on-grid electricity is not available.

With respect to the project, RESCOs can be developed as effective stakeholders in conducting energy efficiency audit for rural distribution network, GHG emission study and market transformation activities for promotion of energy efficiency appliances.

## **6. National Climate Change Steering Committee (NCCSC) and National Climate Change Secretariat (NCCS)**

The NCCSC is a high level inter-ministerial policy coordination body responsible for the overall climate change policy formulation in Liberia. NCCS, is the operational arm of NCCSC which provides coordination, monitoring of programs, implementation of policies and carrying out administrative supervisory functions on relevant climate change issues. The NCCSC is, however, non-operational currently, after its inaugural meeting<sup>28</sup>. This is due to the inherent complexity involved in inter-sectoral coordination as well as capacity constraints, both in terms of operational budgets and technical capacity.

Through the project, trainings will be conducted for NCCS to address the technical capacity constraints it is currently facing.

## **7. The Bureau of Standards**

It is responsible to establish standards which ensures accuracy of meters and gauges, product safety, security, reliability, consistency, purity and availability as well as timelines in responding to stakeholders. The Bureau, however, currently does not have any standard for energy efficient lighting and appliance.

Through the project to develop standards for procurement of energy efficient LED bulbs in the Pilot Program. Going forward, the Bureau will play a pivotal role in the evolution of standards and labelling initiative for energy efficient appliances.

## **8. The Ministry of Finance and Development Planning (MFDP)**

Formed by combining the erstwhile Ministry of Finance and Ministry of Planning and Economic Affairs, MFDP has the mandate to formulate, institutionalize and administer development, fiscal and

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<sup>28</sup> Source: [RIU Report](#)

tax policies for the efficient management of financial resources of the government. It combines public finance, development planning and economic management expertise to effectively manage the economy.

The development of financial mechanism for pilot distribution as well as incentive mechanisms which encourage uptake and mainstreaming of energy efficient appliances in the project is the area of work of the MFDP. The development of policy and legislations for the gradual phase out of incandescent lamps would also be the responsibility of MFDB.

## 9. Environmental Protection Agency (EPA)

EPA, established in 2003, is the principle body for implementing policy and sustainable management law for protection of natural resources of Liberia. It has the executive authority over all environmental activities and programmes relating to environmental management in Liberia.

Capacity building activities in EPA in the field of energy efficiency, renewable energy and other low carbon technologies, will help in formulation appropriate policies to promote usage of low emission energy sources. This project will also help EPA in formulating a baseline methodology for GHG emission data estimation.

During the PPG phase, several stakeholders were consulted to understand their expectations and willingness to work towards the GEF financed project. A summary of the consultations is shown below:

Stakeholder	Name	Desigation	Key points discussed
RREA	Stephen V Potter	Acting Program Director	<p>RREA is a government entity with the mandate to provide energy services to Rural Liberia on commercial basis using locally available renewable energy sources. RREA is also involved in acceleration of provision of energy services. It provides technical and financial support to government organisations. It focuses on interventions mainly outside Monrovia</p> <p>ECOWAS Centre for Renewal Energy Efficiency Project (ECREE) has been established and have developed action plans for all countries to follow and Liberia is included</p> <p>A DRAFT policy framework is available on the MLME website. Energy efficiency is conceived and no framework is available at present</p> <p>Key projects being implemented is the Lighting Live in Liberia Project (LLLP) funded by IFC and WB. To date 31k of lighting imported; 25k sold so far.</p> <p>The project was initiated in 2012. The target is to have about 100k in 2020. Local partners was used to distribute to the projects i.e using filling stations and retailers. Cost has been high for Counties outside Monrovia due to the distances and the nature of the road. The plan is to have Retailers and Distributors resident in these Counties.</p>



			<p>RREA is open to take the lead for Rural Energy efficiency project with LEC supporting is the technical role.</p> <p>RREA needs support in the area of education to the populace on Energy efficiency and institutional capacity</p>
<b>LEC</b>	Ian Yapp	LEC Board Chairman	<p>LEC is responsible for most aspects of the electricity sector.</p> <p>Liberia is behind when it comes to regulatory issues in the Energy sector. The Liberia regulatory Board is yet to be established. Liberia has signed the ECOWAS Energy Efficiency protocol</p> <p>Energy availability and Efficiency is a two way affair. Having the discussion now to rally accessibility with efficiency is a positive step</p> <p>100 MW in demand to meet needs; 15 substations;</p> <p>Power cost 54cents per kilowatts; 30/35 cents- on Generator cost</p> <p>RREA can still lead with the support of LEC but clear regulations need to be in place</p>
<b>MLME</b>	Sylvester Masaquoi	Lead on ECREE project	<p>The department of Energy and RREA are the implementing Partners. The MLME has passed the Electricity law available on the website</p> <p>It has available an Energy policy developed in 2009</p> <p><b>Next action point to explore</b> - A survey on usage of energy efficiency; A plan on how many household to get electricity and when to be connected- see LEC</p> <p>Liberia has signed up to the action plan on ECOWAS Energy Efficiency project. The action plan was validated in August</p>
<b>LEC</b>	Joe Mayah  Mohammed Sow	LEC managing director  Project Manager	<p>National policy is coordinated by MLME &amp; LEC implements all Energy projects in the country</p> <p>38 megawatts to date; 40k customers across the country excluding commercial entities</p> <p>LEC currently spending about 80% on fuel</p> <p><b>Capacity building areas</b> - Hands on vocational schools; Mentoring programs; Community colleges</p> <p><b>Other areas to explore</b> - CLSG – Document on the electricity plan; LEAP – EUR 4M; Pleebo to Fish town (River Gee) connections; Share the USAID Funded Tetra Tech Distribution ToR with PwC; Tetra Tech has been appointed the interim advisors of LEC to replace</p>

			MHI ; There is an energy regulatory consultant
<b>MOCI</b>	Lasana Donso	Director in charge of standards	<p>Liberia has not developed any standards on its own. It rather adopts International standards and tailor to meet its local needs. Currently the country is using an International standards on appliances from Nigeria. This includes items such as air conditions, refrigerator</p> <p>Presently, standards for testing, quality etc. for LED bulbs are not available at present</p> <p>He is the only person involved in the Standard in the Ministry and need more capacity</p> <p>Acts on National Standards are being passed; Need institutions to be involved in the solar energy</p>

## **Annex L: Terms of References for key positions under the project**

### **National Project Director (NPD)**

**Post title:** National Project Director (NPD)  
**Duration:** Year 1 – 3  
**Date Required:** July 2017  
**Duty station:** Monrovia – Project Implementation Committee (PIC)  
**Counterpart:** N/A  
**Background:**

A National Project Director (NPD) will be appointed to the Project Implementation Committee (PIC) and the Project Management Unit (PMU) to oversee and support the implementation and progress of the GEF financed project. The NPD will be the representative of the Government of Liberia for the project.

### **Roles and Responsibilities**

The NPD will be tasked with the following roles and responsibilities:

- To provide overall guidance and support to the Project Manager (PM) and the PMU in procurement, hiring, project planning, finalizing project implementation timelines and other key activities
- Mobilizing national institutions such as the MLME, NCCS etc. for smooth implementation of the GEF financed project.
- Support in establishment of the PIC, PMU and the RMUs.
- Support in hiring of key personnel, including the PM, expert committee, inventory managers and support staff
- Ensure active and effective coordination with the LEAP project.
- Facilitate mid-term review and final evaluation of the GEF financed project, support dissemination of lessons learnt, identify gaps and propose key mitigation measures
- Reporting the project progress to the Project Steering Committee (PSC) as per the Monitoring and Evaluation (M&E) plan
- Managing the project finances in line with the GEF-AfDB guidelines and approve expenditure as provided in the project budget and the implementation plan
- Approving annual reports and knowledge/training material for submission to the PSC and AfDB
- Approve payments according to the agreed deliverables
- Oversee the implementation of the GEF financed project, especially trainings and M&E

### **Qualifications**

- Advanced university degree (preferably MPP) /advanced management degree (MBA) and at least 7 years of professional experience in energy management/ environmental policy and/or energy efficiency, including extensive knowledge of the international context.
- Experience in managing projects of similar complexity and nature, including demonstrated capacity to actively explore new, innovative implementation and financing mechanisms to achieve the project objective.
- Extensive experience in project management
- Strong analytical and problem-solving skills and experience with adaptive management
- Good knowledge and fluency of English

## **Project Manager**

**Post title:** Project Manager  
**Duration:** Year 1 – 3  
**Date Required:** July 2017  
**Duty station:** Monrovia – Project Management Unit (PMU)  
**Counterpart:** LEAP project coordinator, PIC (LEAP)

**Background:**

A full-time **Project Manager (PM)** will be hired for the PMU to coordinate and execute the day-to-day activities of the pilot project. The PM will coordinate with the LEAP team in the LEC and will be responsible for execution of the pilot project, as per component B of the GEF financed project. The PM will: i) report to the NPD; and ii) manage the project in line with budget and work plans, and in accordance with GEF and AfDB guidelines.

### **Roles and Responsibilities**

The PM will be tasked with the following roles and responsibilities:

- Ensure coordination among all key stakeholders including training agency, relevant ministries and NCCS for smooth execution of training and capacity building activities
- Report to the NPD on the status of the training programs conducted, specific observations and key issues faced
- Engage with the NPD and sub-contractors to ensure timely payments and smooth coordination
- Support the NPD in establishment of the RMU and coordination with the LEAP project
- Conduct meetings with important stakeholders and finalize pilot project implementation plan and timelines
- Support the NPD in engagement of firm to supply LED bulbs and firm to dispose used incandescent bulbs
- Overall management of the pilot project and establish smooth coordination with the RMUs
- Manage activities within the sanctioned budget and ensure timely completion of project components
- Provide regular updates to the NPD and the PIC on the status of pilot project
- Support the NPD in conducting M&E of the GEF financed project

### **Qualifications**

- Advanced university degree/advanced management degree (MBA) and at least 5 years of professional experience in project execution. Experience in similar projects will be preferred.
- Experience in managing projects of similar complexity and nature, including demonstrated capacity to actively explore new, innovative implementation and financing mechanisms to achieve the project objective.
- Extensive experience in project management
- Strong analytical and problem-solving skills and experience with adaptive management
- Good knowledge and fluency of English and local language

## **Environment specialist**

**Post title:** Environment specialist  
**Duration:** Year 1 – 3  
**Date Required:** July 2017  
**Duty station:** Monrovia – Project Management Unit (PMU)  
**Counterpart:** N/A

### **Background**

The committee of experts will be equipped with an **environment specialist/expert**, whose specialized knowledge in the environmental subject matter to support the PIC and PMU to support the development of environmental sector policy and strategies, preparation of training program materials, ensuring the project execution in an environment friendly manner and support in procurement.

### **Roles and Responsibilities**

The environment specialist will be tasked with the following roles and responsibilities:

- Review the internationally accepted environmental guidelines for safe disposal of hazardous material and support in development of mechanism for disposal of incandescent bulbs in Liberia
- Coordination with training agency and support in preparation of training scope and material from the viewpoint of environmental norms
- Provide support to relevant ministries and NCCS in policy development, and collection and analysis of baseline GHG emission data
- Provide support to the procurement specialist in including aspects of environmental subject matter in all tender documents
- Support the PM in day-to-day execution of the pilot program
- Provide status reports to the PM and the NPD on a monthly basis
- Conduct an environment audit of the project areas after completion of the pilot program
- Oversee safe disposal of incandescent bulbs collected from consumers in project areas
- Support the procurement specialist in quality control of procured goods

### **Qualifications**

- Post graduate degree in Environment sciences or any other relevant field
- At least 5 years of professional experience in similar projects. Experience in execution of similar projects will be preferred.
- Strong analytical and problem-solving skills and experience with adaptive management
- Good knowledge and fluency of English and local language

## **Inventory Manager**

**Post title:** Inventory Manager (IM)  
**Duration:** Year 1 – 3  
**Date Required:** July 2017  
**Duty station:** Monrovia – Regional Management Unit (RMU)  
**Counterpart:** N/A

### **Background:**

Each Regional Management Unit (RMU) will be staffed with an Inventory Manager (IM), a Regional Coordinator (RC) and 2 support staff. The IM will be responsible to maintain the required stock of LED bulbs in the local warehouses, and timely delivery of these bulbs to LEC offices for distribution.

### **Roles and Responsibilities**

The inventory manager (IM) will be tasked with the following roles and responsibilities:

- Maintain stock of LED bulbs in the local warehouse(s)
- Coordinate with respective RC for transport of required quantity of LED bulbs to LEC office for distribution (daily activity)
- Keep inventory database up-to-date on a real time basis
- Maintain record of collected incandescent bulbs the local warehouse(s)
- Coordinate with LED bulb supplier to ensure timely supply of LED bulbs to local warehouse(s)
- Ensure that local warehouses are maintained such that LED bulbs are not damaged and incandescent bulbs can be disposed off easily

### **Qualifications**

- A Bachelor's degree in any field
- At least 3 years of work experience in inventory management, or similar assignments
- Fluency in English and local language

### **Agency for conducting training programs**

Component 1 of the GEF financed project involves capacity building of relevant ministries and NCCS in the field of energy efficiency by conducting necessary trainings. In this context, the PMU will engage an external agency for conducting these training programs as per the requirement.

### **Roles and Responsibilities**

The scope of work for the contractor includes conducting the following tasks:

- Understand the key project requirements, intended outcomes, existing national policies (including NEP, NGP etc.) and roles of key stakeholders in the project including MLME, NCCS etc. in development of developing policy planning and regulatory frameworks for the project.
- Interact with key stakeholders such as MLME, NCCS etc. to understand the existing situation with reference to this project and identify key areas for capacity building for each stakeholder.
- Review practices and Standard Operating Procedures followed in other countries, and identify key learnings that can be applied in Liberia.
- Develop a handbook describing best practices on developing policies for enhancing uptake of energy efficient appliances (for MLME) and development of low carbon development roadmap (for NCCS), customized to the Liberian context.
- Conduct training programs, as specified in the following section, on the following topics:
  - Energy efficiency measures and climate change mitigation
  - Impacts of energy efficiency on climate change
  - Formulating comprehensive low carbon development roadmap, which includes scaling up inter-ministerial coordination, drafting long term action plan for mitigating climate change etc.

### **Expected outcomes and timelines**

<b>Deliverable</b>	<b>Description</b>	<b>Timelines (from start of project)</b>	<b>Proposed payments</b>
<b>Training sessions</b>			
<b>Handbooks</b>			
<b>Presentations</b>			
<b>Brochures</b>			

### **Qualifications**

- The service provider (joint venture / consortium) consulting firm should have minimum 7 years of experience in energy efficiency programs, projects or policy level and/or technical assistance for energy efficiency measures, training and outreach

- Significant experience in developing and conducting training programs for energy efficient appliances
- Proposed team leader should have post graduate degree in energy management /energy policy/ environmental policy/ or equivalent qualifications
- Project team leader should have minimum 7 years of energy efficiency /policy related assignments
- Team members should have engineering graduate and/or post graduate in energy related field with 3 years of experience in energy efficiency
- Presence of a strong in-house team of trainers (minimum 3) and outreach campaigns experts



**Agency for supply of LED bulbs**

Component 2 of the GEF financed project involves conducting a pilot program in which energy efficient LED bulbs (6W) will be distributed to a total of 40,000 households (connections) in the project area; each household will be provided with 2 LED bulbs. In this context, the LEC seeks to engage a vendor to supply 80,000 LED bulbs of the stated specifications by the stated timelines. The timelines are tentative and shall be finalized with the contractor after signing of contract.

**Technical specifications of LED bulbs**

Sr. No.	Parameters	Requirements
1.	Light source	SMD LED chip
2.	Lamp Wattage	6W ( Suitable to replace 60 W ICL)
3.	CCT	Warm white (2700K) or Cool white (5700K)
4.	LED Chip Wattage	< 1w
5.	Base Cap	B22d (Bayonet Cap)
6.	Ingress Protection	IP20
7.	Rated Luminous Flux	500 Lumens Minimum
8.	Lamp Efficacy (lm/w)	Minimum 70
9.	CRI	Minimum 80
10.	Beam angle (Typical Value)	120°
11.	Junction temp	Maximum 85°C
12.	LED Chip Efficacy	Minimum 115 Lm/W
13.	Harmonics	Maximum 20%
14.	EMC	Table 6 and 7
15.	Lumen Maintenance @ 85°C	Minimum 70% up to 25000 hrs.( Indoor application)
16.	PF	Minimum 0.9
17.	Life Hours	Minimum 25,000
18.	Rated Voltage	100 V – 300 V
19.	Surge Voltage	> 2.5 kV
20.	Working Temp	-10 to 50 deg C
21.	Working Humidity	10% - 90% RH
22.	Safety Requirement	All Test
23.	Driver Efficiency	>85%
24.	Temperature Cycling test and supply voltage switching test	Product shall be subjected to the following for 5 cycles: 10 °C for 1 hrs. 50 °C for 1 hrs. 30 Sec On and 30sec Off. At the end of test as per (1) and (2) no visual damage shall be

		observed and lamp shall alight for more than 15 min after test.
25.	Accelerated operational life test.	Product shall be operated continuously for 6000 hours. Test has to conduct at 45°C At the end of test, no visual damage shall be observed and lamp shall alight for more than 15 min after test.

### **Delivery schedule**

**Total number of LED bulbs to be supplied – 80,000**

### **Roles and Responsibilities**

The scope of work for the LED bulb supplier includes:

- Engage and coordinate with the Liberia Electricity Corporation (LEC) and other stakeholders in finalizing the delivery schedule and warehouse locations within 30 days of signing of contract, or on date specified by the LEC
- Ensure timely supply of specified quantities of LED bulbs as per the delivery schedule
- Provide a warranty for technical performance of LED bulbs for a period of 3 years to the LEC. The contractor will reimburse the LEC for all bulbs found to be defective within this period.
- Arrange transportation of the LED bulbs to the local warehouses. The contractor shall bear all risks till the time the LED bulbs are delivered to the locations specified in the delivery schedule.

### **Qualifications**

- The firm should have minimum presence of 4 years of experience in the lighting industry and should be a registered supplier of LED bulbs
- The firm should have supplied a minimum of 1 million lighting equipment in the last 3 years or a minimum of 100,000 LED bulbs in the last 5 years or both.
- The firm shall have a minimum net revenue of USD 1 million in the last 3 financial years, and should have been profitable for all three years in that period.
- The firm should not be blacklisted by any national or international agencies such as the United Nations, World Bank etc.

### ***Agency for Measurement, Reporting Verification (MRV) of project sites***

Component 2 of the GEF financed project involves conducting a pilot program in which energy efficient LED bulbs (6W) will be distributed to a total of 40,000 households (connections) in the project area; each household will be provided with 2 LED bulbs. In this context, the LEC seeks to engage an agency to conduct Monitoring and Verification (M&V) of the project sites to determine the success of the program and overall benefits.

### **Roles and Responsibilities**

- Carry out an extensive survey of the project locations in consultation with the PMU, the PIC and the LEC. The locations of the survey, the questionnaire content, number of households to be visited etc. will be determined by the agency and the PIC.
- Preparation of a detailed project report that describes the findings of the survey, key barriers identified, suggestions from consumers and overall effectiveness of the pilot program.

### **Project locations**

The pilot project will be conducted in the same locations as those of the baseline project, LEAP. The project locations are:

1. **The Monrovia - RIA corridor** – The LEAP project involves construction of transmission and distribution lines, and substations across the Monrovia – RIA corridor over a distance of approximately 46 km. New connections will be provided from Paynesville through Schiefflin to the Roberts International Airport.
2. **Pleebo - Fish Town corridor** - The Pleebo-Fish Town corridor will involve the construction of transmission and distribution lines and substations from Pleebo (Maryland County) to Fish Town (River Gee County) in south-eastern Liberia. This will cover a distance of approximately 100 km across 19 towns.

### **Qualification**

- The firm should have experience in similar projects in the last 3 years
- The firm shall have a minimum net revenue of USD 0.5 million in the last 3 financial years, and should have been profitable for all three years in that period.
- The firm should not be blacklisted by any national or international organizations such as the United Nations, World Bank etc.