

## Feasibility Assessment Report<sup>1</sup>

### Access to Clean Cooking Solutions in Susan's Bay, Sierra Leone



**Source:** ILEM-Africa on ENACT Project in Susan's Bay (Freetown, March 2022)

<sup>1</sup> A draft of this Feasibility Assessment Report was submitted on 23<sup>rd</sup> April 2022, and a final version submitted on 10<sup>th</sup> August 2022 after third review comments from ENACT Project Management Team.

**DISCLAIMER**

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**Service Provider** ILEM-Africa

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**REFERENCES**

**COMMON ACRONYMS AND DEFINITIONS**

<b>CEIC</b>	Census and Economic Information Centre
<b>CCA</b>	Clean Cooking Alliance
<b>CODOHSAPA</b>	Centre of Dialogue on Human Settlement and Poverty Alleviation
<b>COPD</b>	Chronic Obstructive Pulmonary Diseases
<b>E4I</b>	Energy for Impact
<b>ECREEE</b>	ECOWAS Centre for Renewable Energy and Energy Efficiency
<b>ENACT</b>	Enabling African Cities for Transformative Energy Access
<b>ESHIA</b>	Environmental, Social and Health Impact Assessment
<b>ESPs</b>	Energy Service Providers
<b>FINIC</b>	Fomel Industries and National Industrialization Center
<b>GIZ-EnDev</b>	German Agency for International Corporation-Energizing Development
<b>FEDURP</b>	Federation of Urban and Rural Poor
<b>FCC</b>	Freetown City Council
<b>FCDO</b>	Foreign Commonwealth and Development Office
<b>GEF</b>	Global Environment Fund
<b>GDP</b>	Gross Domestic Product
<b>GNI</b>	Gross National Income
<b>HAP</b>	Household Air Pollution
<b>ICLEI-Africa</b>	Local Government for Sustainable Development
<b>ICS</b>	Improved Cookstove
<b>ILEM-Africa</b>	Institute of Leadership, Energy, Environment and Management
<b>LDC</b>	Least Developed Country
<b>LPG</b>	Liquefied Petroleum Gas
<b>MDAs</b>	Ministries, Departments, and Agencies of Government
<b>MFI</b>	Microfinance Institution
<b>MoE</b>	Ministry of Energy
<b>NCEAPs</b>	National Cooking Energy Action Plans
<b>NDC</b>	Nationally Determined Contribution
<b>NP</b>	National Petroleum
<b>PIP</b>	Project Implementation Plan
<b>REEE</b>	Renewable Energy and Energy Efficiency
<b>TEA</b>	Transforming Energy Access
<b>SDG-7</b>	Sustainable Development Goal-7
<b>SLIHS</b>	Sierra Leone Integrated Household Survey
<b>SMEs</b>	Small and Medium Enterprises
<b>UNDP</b>	United Nations Development Programme
<b>WACCA</b>	West Africa Clean Cooking Alliance
<b>WHO</b>	World Health Organization

## I. EXECUTIVE SUMMARY OF THE STUDY

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Funded by the Foreign Commonwealth and Development Office (FCDO) of the UK Government, through the Carbon Trust, ICLEI-Africa in partnership with Energy4Impact (E4I) are implementing the Enabling African Cities for Transformative Energy Access (ENACT) Project in the framework of the Transforming Energy Access (TEA) programme. ICLEI is spearheading the implementation of this project as part of its mandate supporting policy and local actions for low carbon emission and sustainable development. Whereas the ENACT Project seeks to *“create an enabling environment to improve energy security in Africa’s urban areas, with a focus on the urban poor living in informal settlements, by introducing market-led interventions for improved energy access”*. The ENACT project is targeting two cities in Africa namely Kampala-Uganda in East Africa, and Freetown-Sierra Leone in West Africa which is the focus of this Feasibility Assessment on access to clean cooking solutions in Susan’s Bay. Susan’s Bay is one of the deprived slum communities in Freetown, hence the target community for this assessment.

As the gap in access to modern cooking energy services widens due to population growth in Susan’s Bay, it was necessary therefore to conduct a Feasibility Assessment on access to cooking energy for inhabitants of the community. Information generated during the conduct of this Feasibility Assessment will inform the kind of business model to employ in a Pilot Project Implementation Plan on access to clean cooking solutions in Susan’s Bay

As one of the three procured Service Providers and ENACT Project Partner to conduct this Feasibility Assessment, ILEM-Africa unlike the two private sector companies (AfriGas, and PayGas) which will naturally promote the use of LPG for cooking, ILEM-Africa will assess existing cooking culture and recommend actions for transitional cooking solutions to modern energy cooking services. ILEM is an Africa-centric Regional “Think Tank” Hub-of-Excellence established on the premise to provide technical assistance on policy formulation, programming, and capacity building (training and mentoring) support services. In the framework of this assignment, ILEM’s technical support services falls under the company’s **Thematic Outlay II** i.e., Energy Policy Advisory and Sustainable Clean Cooking Solutions. Highlight of ILEM-Africa’s work in the energy space are on the company’s website [www.ilem-africa.org](http://www.ilem-africa.org).

## II. STATE OF PLAY OF COOKING ENERGY REGIME IN SIERRA LEONE

**2.1. Country Overview** – Sierra Leone is one of the Least Developed Countries (LCD), ranked 163 of 190 countries with a surface land area of 72,300 km<sup>2</sup>. The country is situated on the West Atlantic Coast of Africa boarded by Guinea at Northeast, and Liberia along the Southeast. The demographic population of Sierra Leone is estimated to be 7.72 million with Freetown as its capital City. The country's GDP is about 3.675 billion<sup>3</sup>, and its GNI is said to be US\$ 500. The primary productive sectors of the economy are Agriculture (59.9%), Service (34%) and Industry (5.8%)<sup>4</sup>.

**2.2. Cooking Energy Access** – It is estimated that about 20.3% of Sierra Leone's population has access to electricity<sup>5</sup>. Despite the potential and growing need for renewable energy (solar and hydroelectric power), the majority of the population still depends on biomass (firewood, and charcoal) as primary energy source for cooking. Given that most of the population lack access to energy, most households therefore use petrol or diesel generators, kerosene, battery lamps, candle and/or solar lamps to light-up their homes and businesses.

Energy for cooking is disaggregated along four sources namely **Firewood** is estimated at about 72%; over 27% use **charcoal**; about 0.99% use **LPG**; and almost 0.2% use **animal waste/biogas**. Energy consumption in Sierra Leone is dominated by biomass with over 99% of households cooking with fuel-wood or charcoal. With charcoal consumption increasing from 20% in 2011 to 28% in 2018<sup>6</sup>, and considering the country's population projected to be over 10 million by 2030, the increasing demand for biomass for cooking energy would exceed the regrowth rate of the forest cover. It is therefore safe to predict that biomass fuel for cooking in Sierra Leone is unsustainable.

<sup>2</sup> UN Data <http://data.un.org> accessed October 2019

<sup>3</sup> World Bank <https://data.worldbank.org> accessed November 2019

<sup>4</sup> World Bank, 2019, Doing Business 2020: Economy Pro file -Sierra Leone

<sup>5</sup> <http://www.se4all-africa.org/seforall-in-africa/county-data/sierra-leone>

<sup>6</sup> According 2018 Sierra Leone Integrated Household Survey | Report

**2.3. Overarching Policy and Programmatic Initiatives on Cooking Energy** – In an effort to assess the feasibility of having clean cooking energy in Susan’s Bay community, a broader insight is provided to ascertain efforts made by the central government with support from development partners in formulating upstream policies and implementing downstream programmes addressing cooking energy needs in Sierra Leone. During this Feasibility Assessment, ILEM-Africa met with the Ministries of Energy, and Environment, GUMA Valley Water Company, and the Environment Protection Agency to underpin policy and programmatic initiatives spearheaded by the Government of Sierra Leone on integration of cooking energy in environmental management and the general electrification plan for the country:

**2.3.1. Policy Alignment** – During this assessment, we noted that development partners have supported the Government of Sierra Leone’s policy incentives on energy access and productive use. In February 2016, Sierra Leone became the first African Country to sign the Energy Africa Policy Compact and launched an “**Energy Revolution**”, to increase access to renewable energy in the country to 80% by 2030 with strands on cooking energy as outlined in Table 1

**Table-1:** List of Policies on the implementation and effects of renewable energy and clean cooking options in Sierra Leone

Policy Interventions	Year	Purpose and Recommendation Actions	Target
<b>National Energy Policy and Updated Strategic Plan</b>	2020	<ul style="list-style-type: none"> <li>❑ <i>Outlines a strategy for implementing energy policy on <u>rural electrification</u> and prioritizes off-grid solar systems to meet energy needs in rural areas.</i></li> <li>- <i>Recommends incentives for home owners who install energy efficient appliances for lighting (including for cooking).</i></li> <li>- <i>Offers incentives for importers and producers to deal in energy efficient appliances and provides credits for companies who produce energy efficient appliances, including cooking.</i></li> </ul>	1.7 million rural communities having access to energy access by 2030 by improving governance of the energy sector and facilitate low-cost energy projects in all districts.
<b>National Electrification Strategy Analysis</b>	2018	<ul style="list-style-type: none"> <li>❑ <i>Makes provision for community involvement by involving local/slum and rural communities in promoting electrification use (which include lighting and cooking). Setting rural electrification</i></li> </ul>	37% of rural population (including slum) access renewable energy by 2030.



Enabling African Cities for Transformative Energy Access

Policy Interventions	Year	Purpose and Recommendation Actions	Target
		<i>committee meetings in advance of electrification to assess demand and needs.</i>	
SE4All Country Action Agenda	2015	❑ Sets objectives and strategies for renewable energy development and energy efficiency.	Increasing energy access to 92% by 2030.
ECREEE Renewable Energy Policy (including Sierra Leone)	2013	❑ Sets regional targets for renewable energy development (e.g., promoting 60,000 mini-grids and 2.6 million stand-alone systems across the region by 2020 at a cost of €13.6 billion.	To serve 71.4 million people in West Africa.
National Cooking Energy Action Plan (NCEAP)	2020	❑ Focuses on producing wood fuel sustainably, consumption of woodfuel efficiently, increase the use of LPG as alternative to wood fuel for cooking, and scale-up the use of biogas and agri-residues as alternative to firewood for rural (including slum communities).	Reduces the use of biomass (charcoal/firewood) to 60%/80% by 2030.
Bioenergy Policy	2017	❑ Create an enabling framework to access clean and modern energy cooking services for increased productivity, wealth creation and improved quality of life for all Sierra Leoneans by ensuring energy security and reduce over dependence on imported oil.	Increase LPG penetration from 0.99% to 20% by 2030 and Biofuel from 0.2% to 20% by 2035.
Cleaner Cooking Energy Compact	2021	❑ Was formulated to affirm commitment by the Government of Sierra Leone to address traditional cooking practice, and seek support to invest on cleaner cooking options and improve the cooking sector by providing alternatives.	Increase the use of LPG to 25% by 2030, and ALL households have access to energy-saving cooking solutions.

During the conduct of this Feasibility Assessment, consultative meetings were held with the Ministries of Energy, Environment, Environment Protection Agency and GUMA Water Company. Below are photos summarizing different meetings held as part of the consultative process.



**Photo 1:** Meeting with the Director of Renewable Energy 17th/03/22 | **Photo 2:** Meeting the Minister of Environment 12th/04/22 | **Photo 3:** Meeting MD of Guma 20th/04/22 | **Source:** ILEM-Africa on ENACT Project (April 2022)

**2.3.2. Programmatic Interventions – A “Cleaner Cooking Energy Compact”** has been formulated by the Ministry of Energy with support from GIZ-EnDev and submitted to the UN High-Level Energy Panel in September 2021. It serves as a blueprint to address biomass cooking practice in Sierra Leone. Resources are yet to be mobilized to implement designed project activities. In an effort to provide alternative cooking energy options from the use of biomass, there are already a number of national programme interventions outlined here-below:

**Table-2:** List Programme Interventions addressing clean cooking energy access in Sierra Leone

Programme Interventions	Year	Purpose and Recommended Actions	Target
Energy Efficient Charcoal and Cookstove Project	2017	<input type="checkbox"/> Through support from UNDP, US\$ 1.9 million was provided to implement an “ <b>Energy Efficient Charcoal and Cookstove Project</b> ”, which seeks to address deforestation forest for charcoal fuel for cooking, by introducing sustainable charcoal production.	Save 40 hectares of woodlots for cooking.
FCC Tree Planting Project	2019	<input type="checkbox"/> As part of the Transform Freetown Campaign, The Mayor of Freetown and her administration are working the key MDAs, development partners and local communities on a tree and mangrove planting to address the recurring climate change impact in Freetown, and slum communities (like Susan’s Bay)	Plant 1 million trees across 13 catchment areas and slopes, and restore the natural ecosystem by 50% by 2022.
National Tree Planting Project	2021	<input type="checkbox"/> In an effort to respond to policy commitment Cluster 7 of the Medium Term National Development Plan (MTNDP 2019 – 2023) seeking to address the national environmental resilience, the Ministry of Environment is working with local Services Providers to establish “Community Forest Management Committees” in all five regions of the country to mitigate climate change effects due to deforestation for human settlement and charcoal for cooking.	1.2 million trees plant seedlings planted by 2020, with the aim to plant 5.5 million trees by 2023

Our analysis of formulated upstream policies and efforts towards implementing downstream programmes with defined targets on energy access, clean cooking and environmental management in Sierra Leone is indicative that there is strong political will to address the cooking energy sector from the use of biomass (firewood and charcoal) energy as cooking fuel to a cleaner and sustainable alternative such as Improved Cookstoves, bioenergy and LPG.

Supported by ECREEE, UNDP, EU, World Bank, and GIZ-EnDev, these efforts demonstrate that there is a policy will and programmatic strength at national level to reform the cooking energy sector. These efforts will surely provide a framework for partnership in the implementation of clean cooking energy project in Susan's Bay.

### III. FREETOWN CITY COUNCIL TRANSFORMATIVE AGENDA

Founded in 1787 Freetown was the haven for freed slaves. It served as a Naval Base during World War II, and used to be the mecca for academic excellence in Sub-Sahara Africa with the first tertiary learning institution called Fourah Bay College. In 1961, Freetown became the capital city of Sierra Leone. Although the city is home to only 15% of the country's population (i.e., 1.2 million) and occupies less than 0.5% of the land mass of country, Freetown however accounts for 30% of the country's GDP<sup>7</sup> making it the country's engine for economic growth. Once elected as the new Mayor for Freetown in 2018, Her Worship Mayoress Yvonne Aki-Sawyers set an ambitious **Transform Freetown Agenda 2019–2022**. This development-planning guide of Mayor Aki-Sawyers outlines 11 priority sectors clustered into 4 themes with defined targets and identified initiatives, namely, **i. Resilience**; **ii. Human Development**; **iii. Healthy City**; and **iv. Urban Mobility**. To put in context, the ENACT Feasibility Assessment on access to clean cooking for Susan's Bay, falls under "**Priority I – Resilience**" and **Target 2** of the FCC development planning initiative i.e., '*Ensuring an effective multi-stakeholder collaboration to strengthen environmental governance*'. Cognizant of the environmental effects of deforestation for human settlement and the use of biomass for cooking, the Mayor's *Tree Planting Project* of 550,000 trees planted in 2020. This Feasibility Assessment provides insight on alternatives on access to cleaner cooking energy solutions for slum communities like Susan's Bay.



**Photos 4, 5 & 6:** Meeting with Mayor of Freetown, FCC Delivery Unit Team on 16<sup>th</sup>/03/22, including ENACT Project Team, and Project Partners | **Source:** ENACT Project Team (Freetown, March 2021)

<sup>7</sup> Transform Freetown Agenda 2019 – 2022

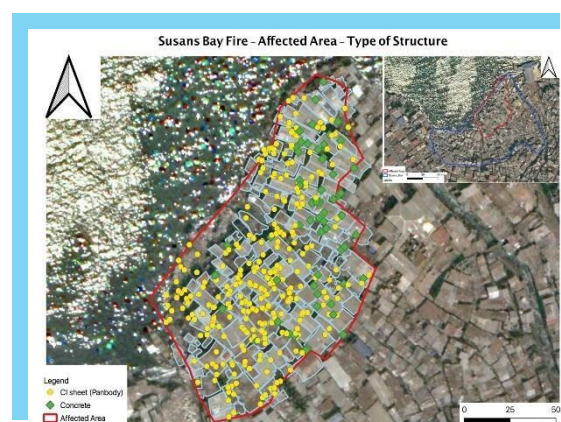
#### IV. SUSAN'S BAY COMMUNITY AT A GLANCE

Susan's Bay is one of the largest and poorest seaside informal settlements in Freetown and is home to almost 4,500 people from **1,566 households**<sup>8</sup>, who are unable to access formal housing. As such, people are forced to live in overcrowded and unsanitary conditions with little access to roads, healthcare and to clean cooking options. From the survey conducted in the framework of this assignment, it is recorded that **98%** of the population rely on biomass energy (i.e., **83%** charcoal, and **15%** firewood users) for cooking energy. **See Figure 3 of this Report.**

Changing this cooking fuel narrative would require concrete action. As noted by Mr. Yirah Conteh, Coordinator of Federation of Urban and Rural Poor (FEDURP) during our Feasibility Assessment, the best way to transform Susan's Bay is to *"Take the slum out of the people, and not the people out of the slum"*. It was observed during our field assessment that many of the houses are close-knit built without consideration of disaster risks. Noting that this unplanned spatial settlement in Susan's Bay increases risks to disaster, the need therefore to understand the challenges faced by the community and proffer solutions addressing the problems.

On 24<sup>th</sup> March 2021, Susan's Bay experienced an inferno which burned to ashes 189 structures including homes and businesses<sup>9</sup>. Although the real cause of the fire remains unknown, it is believed that the outbreak started from poor electrical installation or from firewood used for outdoor cooking. Interviews during this assessment survey indicates that fire outbreak in the community occur most often during the dry season with heavy winds blowing firewood flames and/or charcoal sparkles, which have the propensity to wreak havoc.

**Photo 7:** Indications in red lines depict the size of Susan's Bay affected by the fire outbreak | **Source:** NDRMA/SL 2021



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<sup>8</sup> According to finding in March 2021 by Centre of Dialogue on Human Settlement and Poverty Alleviation (CODOHSAPA)

<sup>9</sup> 2021 Report, Sierra Leone National Disaster Risk Management Agency (NDRMA/SL)

As part of the rebuilding process of Susan's Bay community, this report highlights the lack of access to clean cooking energy, and outlines the environmental, social, and health effects on both the community and its people. The aim is that ensuing recommendations from this Feasibility Assessment will contribute to promoting access to clean and modern cooking options



**Photos 8, 9 & 10:** Depicting the inferno incident in Susan's Bay | **Source:** Switsalone.org (Freetown, March 2021)

## V. METHODOLOGY ADOPTED IN CONDUCTING THIS ASSESSMENT

The methodology adopted in conducting this Feasibility Assessment adheres to the following approaches to ensure that this Report reflects facts from our field exercise.

**5.1. Sample Size and Target Respondents of Survey** – A Survey Questionnaire<sup>10</sup> was drafted in English but administered in Krio, as Krio is the widely spoken local language in Sierra Leone and particularly in Susan's Bay. **163 respondents were interviewed, which represents +10%** (for the sake of survey margin of error) of **1,566 households and local SMEs/enterprises in Susan's Bay community**. The construct of the respondents were **13% male** and **87% female**. Households interviewed constituted **51.5%** of the respondents, and Small Businesses constituted **48.5%** of the respondents. Our direct engagement of key informants/stakeholders (Households, SMEs, MDAs representatives, Energy Service Providers i.e., manufacturers and distributors of firewood/charcoal/cookstove producers, and LPG dealers helped us to ascertain existing cooking means and fuel used in the Susan's Bay community, and document appropriate cooking energy service options to deploy in the community.

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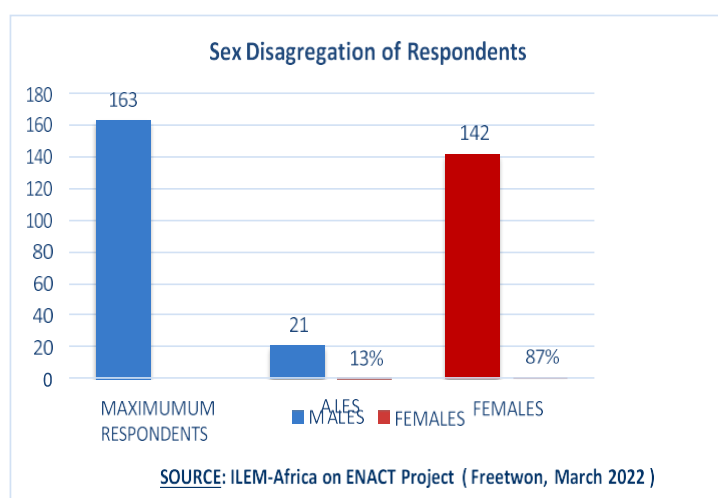
<sup>10</sup> Sample copies of Survey Questionnaire used in the conduct of this assessment of Households and SMEs are annexed

**5.2. Construct of Survey Administration** – ILEM-Africa team worked in tandem with the Councilor of Susan’s Bay (Cllr. Madinatu Kamara) and a local slum dweller association called Federation of Urban and Rural Poor (FEDURP) to ensure that community leaders and influencers (heads of households, councilor, traditional leaders, business entrepreneurs, women and youth leaders etc.) participate in the field survey. In compliance with ILEM-Africa’s data collection guide, each enumerator completed at least 17 questionnaires within a day. Considering the population and sample size (i.e., 163), 5 Data Collectors were deployed and administered the survey within 2-Days (on 30<sup>th</sup> and 31<sup>st</sup> March, 2022). And to ensure active community participation, 2 of the 5 Data Collectors were directly sourced from within the community and supervised by ILEM-Africa.

Table-1: Overview of Susan’s Bay respondents. Clustering & Disaggregation |Source: ILEM-Africa (March 2022)

Description of Survey Size	Number of Respondents	Percentage (%)
<b>Total Number of Respondents</b>	☐ <b>163</b>	- <b>10%</b> of the total number of households and SMEs in Susan’s Bay (i.e., <b>1,566</b> ) community
<b>Clustering of Respondents</b>	☐ 84	- <b>51.5% were households</b>
	☐ 79	- <b>48.5% were SMEs</b>
<b>Sex Disaggregation of Respondents</b>	☐ 21	- <b>12% male</b>
	☐ 142	- <b>87% female</b>

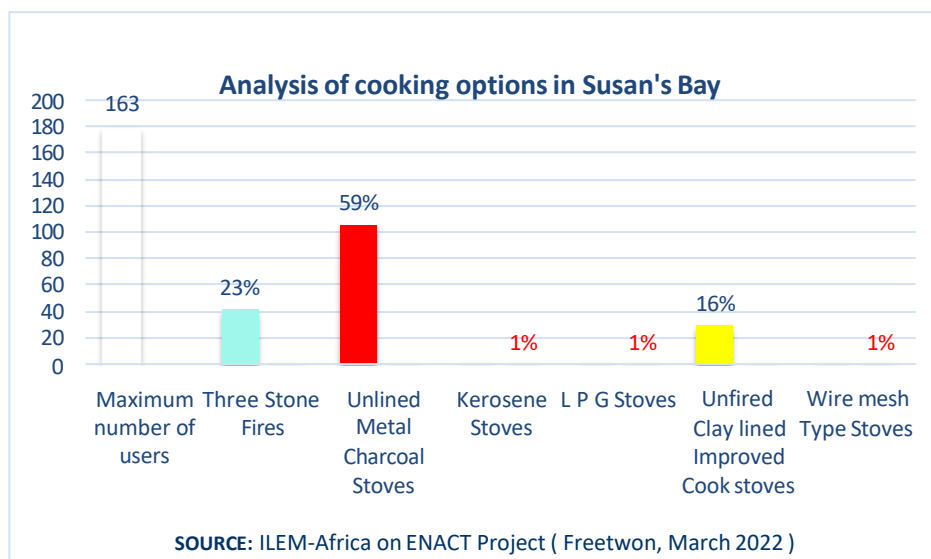
**Figure 1:** Sex disaggregation of respondents in Susan’s Bay Community | Source: ILEM-Africa on ENACT Project (April 2022)



**VI. ANALYSIS OF EXISTING COOKING OPTIONS AND FUELS IN SUSAN’S BAY**

One of the core features of this Feasibility Assessment was to ascertain existing cooking energy sources. Drawn from our field study/assessment in the target community, below is an analysis of the different existing cooking options and fuels used by households and SMEs, which gives a broader insight on cooking culture in Susan’s Bay community.

**6.1. Cooking Options** – In order to proffer an appropriate cleaner transitional or modern cooking option, it is important to firstly understand existing cooking options in Susan’s Bay. While this section provides a detail description of cooking options in Susan’s Bay, below a graphic analysis highlighting survey number and percentage of end-users in the community:



**Figure 2:** Analysis of cooking options in Susan’s Bay | **Source:** ILEM-Africa on ENACT Project (March 2022)

**6.1.1. Unlined Metal Cookstove** The most widely used means for cooking method in Susan’s Bay is the Unlined Metal Charcoal Cookstove, accounting for **59%** end-users in the community. The Unlined Metal Cookstove is fuelled using charcoal.

**Photos 11 & 12:** Illustration of how the Unlined Metal Cookstove is used in Susan’s Bay community | **Source:** ILEM-Africa on ENACT Project (Freetown, March 2022)



This cookstove is mostly made in the form of circular and square shapes and ideally from metal steel plate/sheet with thickness of either 1mm or 1.5mm welded together, but most often made from thin scrap metals from cars. Given the quality of metal used, the Unlined Metal Charcoal Cookstove deteriorates between 2–6 months (**4months on average**) as indicated by survey respondents in Susan’s Bay community, creating need to replace/buy another at least twice in the year. It was observed during our Survey exercise that some borrow from their neighbors or resort to using the Traditional 3-Stonefire for cooking when theirs is destroyed.

**6.1.2. Traditional 3-Stonefire** From our field assessment it was observed that **23%** of the population in Susan’s Bay use the Traditional 3-Stonefire Cooking Method. This cooking method is *the second most widely used means of cooking in Susan’s Bay community* for both households and local SMEs and enterprises. This narrative is not limited to Susan’s Bay but also in other informal settlements and rural communities in Sierra Leone.

**Photo 13:** Hawa Turay, a local restaurant owner using Traditional 3-Stonefire for her restaurant cooking at Susan’s Bay |

**Source:** ILEM-Africa on ENACT Project in Susan’s Bay (March 2022)



The name of this cooking method (Traditional 3-Stonefire) is derived from the literal arrangement of 3 stones and sometimes substituted by bricks placed in a tripod position. Fuelled by firewood placed at either side of the stones, a cooking pot is then placed on top of the stones and the heat generating from the burning firewood flame provides energy for



cooking. While this cooking method is the traditional second mostly widely used cooking means in Susan’s Bay community, it was observed that the firewood burns quickly, and that less than half of the heat generated dissipate in the open air. The conclusion from this observation is that this cooking method is not energy efficient as it expels heat and emits carbon smoke from the burning firewood used as cooking energy fuel.

**Photo 14:** Traditional 3-Stonefire|**Source:** ILEM-Africa on ENACT Project (Freetown, March 2022)



**6.1.3. Unfired Clay-Lined Cookstove** The third most widely used means of cooking in Susan's Bay community is the Unfired Clay-Lined Cookstove, accounting for **16%** of end users in the community. They are conical shaped metal stoves made from cut out pieces of mild steel sheets hammered, bended and welded together but lined with clay that has not been fired on the inside of the upper combustion chamber making it very fragile. It contains an open compartment at the bottom where ash is collected. The weight of some pots can cause the unfired clay to break into pieces, water boiling over from pots or kettles into the stove also causes it to break apart. They are mostly portable, but having clay as the internal lining makes them a little bit heavier. The shape drops as a furnace with an open compartment at the bottom where charcoal residue/ash is collected. Because the pot sits on the charcoal, the metal sheet gets heated making it difficult to ascertain the amount of heat dissipating as the charcoal radiates heat at all four corners of the stove making in not energy efficient. It is also observed that the charcoal used as cooking fuel emits smoke especially when it is lit using plastic. The hazard posed when charcoal is lit mixed with plastic is the release of lethal carbon monoxide.

As the Unlined Metal Cookstove, the Unfired Clay-Lined Cookstove uses charcoal as its fuel. Just like the previous two cooking means, the Unfired Clay-Lined Cookstove has no provision to regulate the rate at which it burns fuel and heat is emitted. They come with foldable or removable pot-rests on which the cooking pot sits. Although air supply cannot be regulated, but charcoal heat radiated to the sides that are clay lined is mostly deflected towards the top where the pot is placed, resulting to some reduction in waste of fuel (charcoal) making it more efficient than the Traditional 3-Stonefire and the Unlined Metal Cookstove. Although it is clay-lined, but because the clay is unfired and the metal plates used to produce it are mostly scraps that are thin, they only last between 2-6months (**4months on average**) as indicated by survey respondents in Susan's Bay community. Hence the need to replace/buy a new one, borrow from a neighbour or friend or resort to using the Traditional 3-Stonefire until funds are available to replace.



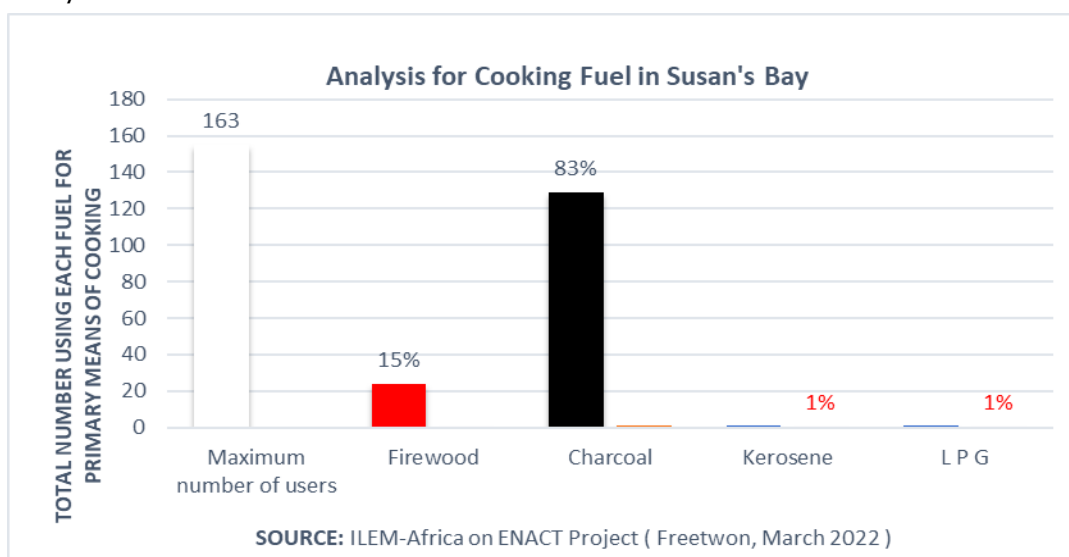
**Photo 15:** Unfired Clay-Lined Cookstove in Susan's Bay | **Source:** ILEM-Africa on ENACT Project (Freetown, March 2022)

**6.1.4. Wire-Mesh Cookstove** During our field assessment, it was recorded that there was only **1 user of the Wire-Mesh Cookstove** in Susan’s Bay. It should be noted that Wire-Mesh Cookstove was the widely used in Sierra Leone before stove producers started making unlined metal charcoal cookstove and unfired clay-fired cookstove. The Wire-Mesh Cookstove as suggested by its name is made of strings of wires in spiral/coil shaped and always made as one- burner cookstove with an open compartment at the bottom. As the unfired clay lined cookstove, charcoal is used as cooking fuel.



**Photo 16:** Wire Mesh Cookstove used in Susan’s Bay community | **Source:** ILEM-Africa on ENACT Project (Freetown, March 2022)

**6.2. Cooking Fuels** – Having analysed cooking options (stoves) used by households and business enterprises in Susan’s Bay community, cooking fuel options were also analysed to be able to define appropriate cleaner and affordable cooking technologies for people in this informal settlement. While this section provides a detail description of cooking fuel in Susan’s Bay, below is a graphic analysis highlighting survey number and percentage of end-users in the community:



**Figure 3:** Analysis of Cooking Fuels in Susan’s Bay Community | **Source:** ILEM-Africa (Freetown, March 2022)

**6.2.1. Biomass - Firewood and Charcoal** Inland Forest woods and wetland mangroves are the major sources of wood supplied and used for cooking in the Susan’s Bay community. It was observed during this assessment that there are trucks and boats full of charcoal and/or firewood ferried into the city on a daily basis. At national level, about **72% use firewood** and over **27% use charcoal** as fuel for cooking. This implies that biomass (firewood and charcoal) amount for **99% of cooking energy** in Sierra Leone “making kitchen graveyard” for the forest reserve which continues to rapidly shrink to meet the demand for biomass. At community level, it was observed that in Susan’s Bay **83% use charcoal** and **15% use firewood** for cooking. Biomass energy which is produced in an unsustainable artisanal manner remains the commonly used fuel for cooking in Susan’s Bay community.



**Photo 17:** Firewood selling point in Susan’s Bay | **Photos 18, 19 & 20:** Charcoal selling points and the retail re-packaging process in Susan’s Bay | **Source:** ILEM-Africa (Freetown, March 2022)

From our assessment, there is a Value-Chain on the production and marketing of firewood and charcoal in Susan’s Bay. It was observed that of the 163 households interviewed, **15 wholesale firewood; 30 retail firewood; 12 wholesale charcoal; and more than 80 retail charcoal** making a total **8.7% of households in the community in the biomass business, meaning the that the sector is a source of livelihood**. The economics and ILEM-Africa’s proposed Business Model to transition to a cleaner cooking option is defined in the Project Implementation Plan of this Feasibility Assessment for consideration by ENACT Project Management Team.



**Figure 4:** Firewood Value Chain **Figure 5:** Charcoal Value Chain | **Source:** ILEM-Africa (Freetown, April 2022)

**6.2.2. Liquefied Petroleum Gas – AfriGas and NP:** There are only two LPG suppliers in Sierra Leone, namely AfriGas (importer and distributor of LPG for cooking), and the NP (National Petroleum - importer and distributor of petroleum products including LPG for cooking). The use of LPG for cooking at national level is estimated to be **0.99%**. During the survey in Susan’s Bay community, it was observed that almost none of the households and businesses own an LPG canister/cookstove, except 1 micro businessman who has a 6kg LPG cookstove which he uses to make a local tea called “Ataya”. This represents **0.6% of LPG users in Susan’s Bay**.

The pressurized steel LPG cylinder is also mostly doubled as the cookstove with a removable burner installed at the top. The LPG imported by the two suppliers and distributors (AfriGas and NP) are Butane gas filled in 6kg, 12kg, and 24kg canisters, which is refilled at their main Gas Depot and sent to distributors and fuel stations where empty canister are replaced.

**Photo 21:** The only 6kg LPG cylinder and cookstove used in Susan’s Bay community | **Source:** ILEM-Africa on ENACT Project (Freetown, March 2022)



**6.2.3. Kerosene** Before the introduction of LPG in Sierra Leone, kerosene was the only petroleum product used for cooking. Over the years most kerosene cookstove users have switched to using LPG. So, it is therefore safe to conclude that at national level, there was about **0.99%** users of kerosene as cooking energy fuel. It was observed that there is only 1 household using kerosene as cooking fuel, representing **0.6% as Kerosene Stove users in Susan’s Bay community**.

**Photo 22:** The only Kerosene cookstove burner in Susan’s Bay community | **Source:** ILEM-Africa on ENACT Project (Freetown, March 2022)



## VII. ESHIA ON TRADITIONAL COOKING CULTURE – NEXUS EFFECTS

Our analysis of cooking culture in Susan's Bay makes us to conclude that the population uses principally **6 cooking options** and **4 cooking fuels**. Below is a table summarizing summary the different cooking options and fuels used in Susan's Bay community. The state of play of cooking energy regime is estimated to be **99% at national level using biomass energy** (i.e., **72%** firewood, and **27%** charcoal) for cooking, and from survey conducted during this assessment it was recorded that **at the level of Susan's Bay community 98% of households and small enterprises use biomass energy for cooking** (i.e., **15%** firewood, and **83%** charcoal).

**Table-4:** Summary of cooking options and fuels in Susan's Bay | **Source:** ILEM-Africa on ENACT Project (March 2022)

Description of Cooking Elements	Categorization	Usage Percentage (%)
<b>Cooking Options</b>	- Unlined Metal Charcoal Cookstove	<b>59%</b>
	- Traditional 3-Stonefire	<b>23%</b>
	- Unfired Clay-Lined Cookstove	<b>16%</b>
	- Wire-Mesh Cookstove	<b>1%</b>
	- LPG Stove	<b>1%</b>
	- Kerosene Stove	<b>1%</b>
<b>Cooking Fuels</b>	- Charcoal	<b>83%</b>
	- Firewood	<b>15%</b>
	- Kerosene	<b>1%</b>
	- LPG	<b>1%</b>
	- Fuel Staking (mix use available fuels)	<b>7%</b>

It should be noted that the use of charcoal for cooking across country increased from 20% in 2011 to 28% in 2018<sup>11</sup>. With population increased projected to be over 10million from current 7.7million by 2030, this means that over reliance on biomass for cooking energy in Sierra Leone is not sustainable, as demand for firewood and charcoal would exceed regrowth rate of the forest which is presently being deforested to feed the biomass energy demand. Energy being an enabler for economic development, and for improving the wellbeing of people, it was important to assess the wider environmental, social and health implications on the use of biomass energy and existing cooking culture in Susan's Bay which is captured in this Report.

<sup>11</sup> According 2018 Sierra Leone Integrated Household Survey| Report [SIERRA LEONE INTEGRATED HOUSEHOLD SURVEY \(SLIHS\) REPORT 2018 \(statistics.sl\)](https://statistics.sl.gov.sl/publications/sierra-leone-integrated-household-survey-slihs-report-2018)

**7.1. Environmental Challenges** – It is estimated that about 38% of Sierra Leone’s remaining forest is decreasing due to deforestation for human settlement, quarrying, agriculture, timber logging, and firewood/charcoal production. At national level, it is reported that the cause of deforestation to source biomass energy result to losing 0.53 million ha/year of the country lush forest reserve. Studies indicate that about 7,984 tons/day of firewood and 457 tons/day of charcoal are consumed in the country<sup>12</sup>. From our assessment in Susan’s Bay, an average household of 3-5 persons would spend about 2kg charcoal or 5-10 kg firewood per day



**Photo 23:** 2017 Mudslide Site at Mortomeh in Freetown |  
**Source:** ILEM-Africa on ENACT Project (Freetown, March 2022)

Despite the introduction of LPG by AfriGas in 2012, charcoal remains the most common energy source for cooking for slum dwellers in Sierra Leone (including Susan’s Bay). Deforestation to produce charcoal amount to over 457 ton/day<sup>13</sup> of charcoal used for cooking daily in Sierra Leone. The effect is environmental degradation, water shortage (*dried-up rivers affecting hydropower supply, and periodic flash flooding during the raining season resulting to river level rise*), biodiversity loss, and climate change effect as seen in the August 2017 mudslide at Mortomeh Regent Village in Freetown which left over 3,000 homeless and more than 1,500 dead. While there is no existing data to show the extent of deforestation for human settlement and for biomass energy on the environment, it can be argued that the barren mountain slopes which have been stripped of almost all vegetation provides no protection from the effect of climate change. Seeking to maintain an environmental governance regime, the world commemorates yearly on 15<sup>th</sup> June, the World Environment Day<sup>14</sup>. In an effort to address the effect of climate change through CO<sub>2</sub> emission reduction, clean cooking is an inclusive strategy to deploy alternative cooking energy sources to mitigate the effect of climate change.

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<sup>12</sup> According 2018 Sierra Leone Integrated Household Survey | Report [SIERRA LEONE INTEGRATED HOUSEHOLD SURVEY \(SLIHS\) REPORT 2018 \(statistics.sl\)](#)

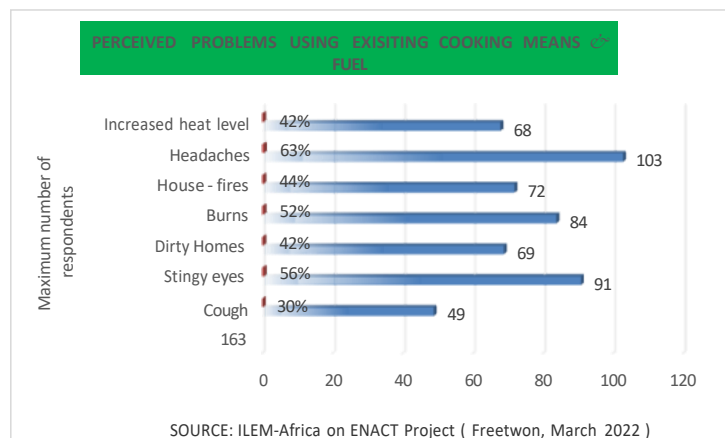
<sup>13</sup> UN Data <http://data.un.org> accessed October 2019

<sup>14</sup> At the Stockholm Conference on the Human Environment in 1972, the United Nations declared 5<sup>th</sup> June as World Environment Day. The aim is to draw attention to environmental challenges and include as people, organizations and governments to drive positive change in preserving and protecting our environment. Since then, 5<sup>th</sup> June is celebrated as the International World Environment Day on 5<sup>th</sup> June.

**7.2. Social Effects** – The alarming rate of deforestation for biomass energy for cooking has a negative effect on the water catchment of Guma. The Guma Valley Water Company is a state-owned water processing and management company, which supplies water to the entire city of Freetown. This implies that inhabitants of Susan’s Bay also rely on Guma for consumable water. Although there has been no study to provide empirical evidence of ongoing deforestation, what is evident is that with population increase, deforestation along the Freetown peninsula (mainly for human settlement and firewood or charcoal production), heighten the risk of the water network/catchment feeding Guma. One key element from our discussion with the management of GUMA is the need to protect the fragile ecosystem around the GUMA dam by putting a protective mechanism that would prevent or at best reduce ongoing deforestation for human settlement and harvesting of forest wood for biomass energy for cooking, hence the need to change the cooking culture to cleaner cooking option. And it was also discussed to find alternative livelihood for people in forest areas who depend on firewood and charcoal production as their daily job. Understanding that cooking culture affect peoples’ decision about cooking systems, it was noted that social habit, peers, and the neighbourhood influence cooking energy choice. During the conduct of this assessment, **respondents admit** that their decision for not using LPG for cooking is because of the belief that it is risky for fire outbreak as the makeshift houses in Susan’s Bay are close-knit built. Hence, a need for community sensitization campaign on safety measures and use of LPG to change perception. **Figure 6 below** captures the perceived problems associated to using existing cooking options and fuels in Susan’s Bay.

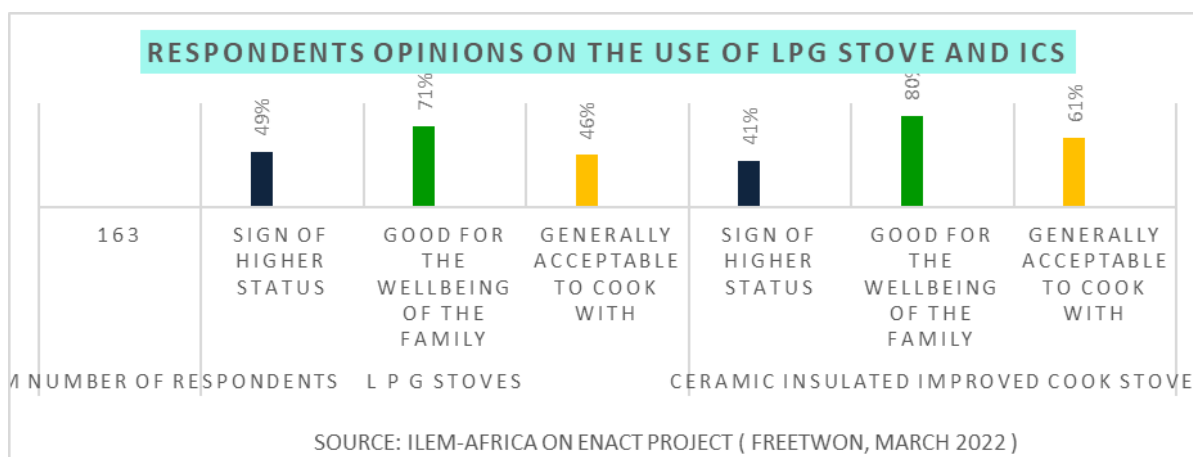


**Photo 24:** Guma Valley Water Dam  
**Source:** Guma (Freetown, September 2020)



**Figure 6:** Perceived using existing cooking options and fuels  
**Source:** ILEM-Africa on ENACT Project (April 2022)

While undertaking this assignment, respondents’ **perception on the cleaner cooking options** which ILEM-Africa through its cookstove production company TERANGA, AfriGas and PayGas intend to introduce in Susan’s Bay community (i.e., Ceramic Insulated Improved Cookstove-ICS, and Liquefied Petroleum Gas-LPG). **Figure 7** below highlights respondents and gauges opinions on the use of LPG stove and ICS as cooking options for households and SMEs in Susan’s Bay.



**Figure 7:** Opinions on Cleaner Cooking Options | **Source:** ILEM-Africa (Freetown, April 2022)

**7.3. Health Implications** – Across Sub-Saharan Africa, it is estimated that around 850 million people rely on biomass energy for cooking. Globally, in 2018 about 4.2 million premature deaths was reported due to illness related to Household Air Pollution (HAP)<sup>15</sup>. From our assessment on this assignment in Susan’s Bay, we realised that **98%** of households and small business use biomass energy (i.e., **83%** charcoal users, and **15%** firewood users) as their principal cooking fuel. It should be noted that these rudimentary cooking fuels emit black lethal carbon monoxide smoke which pose serious health implications with consistent exposure to these acrid smoke and particulates.

<sup>15</sup> <https://www.who.int>



A recent World Bank CEIC<sup>16</sup> data indicates Household Air Pollution (HAP) is the cause for at least 100,000 deaths in Sierra Leone in 2016, noting that the vast majority of affected victims are from informal settlements like Susan's Bay community whose primary energy source for cooking is either firewood and or charcoal. The excessive exposure to respired airborne particulates results to serious health hazard especially for women, children who spend most of their time in the cooking area. It is reported by WHO that a person exposed to HAP smoke are more likely to suffer from Chronic Obstructive Pulmonary Diseases (COPD) diseases such as chronic bronchitis, emphysema, lung cancer, respiratory infections (abnormal heart beat, asthma, memory dysfunction etc.) cataracts, tuberculosis, blindness and adverse pregnancy outcomes, noticeable headaches, stinging eyes, coughs, breathing problems etc. As an outcome of the assessment for this Report, respondents in Susan's Bay community expressed some perceived social and health problems experienced due to exposure to smoke from traditional cooking means and fuels highlighted in **Figure 6**.



**Photo 25:** Galeh Sesay exposure to HAP in Sierra Leone |

## VIII. STAKEHOLDER'S ENGAGEMENT AND MAPPING

In conducting this *"Feasibility Assessment on Access to Clean Cooking Solutions in Susan's Bay"* deliberate effort was made to categorize respondents during our field survey. We were able to determine the number of households, small/micro enterprises, and energy service providers marketing existing cooking energy fuels which will help to inform the deployment of any pilot project on cooking energy technologies/products for Susan's Bay community. Prior the mapping of stakeholders, the ENACT Project Team and Partners engaged with key stakeholders at the level of the FCC Administration, Ministry of Energy, and community ward representatives. This level of engagement provided a broader insight of the different layers in addressing access to clean cooking options for people in Susan's Bay community. Below is a description of the different engagements and mapping outcomes:

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<sup>16</sup> CEIC 2016 Report

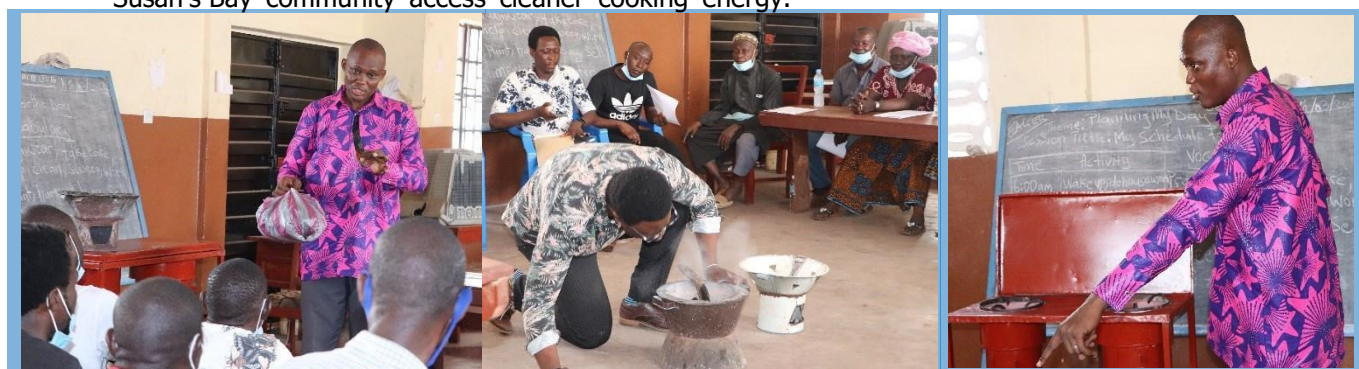
**8.1. Engagement of Stakeholders at Susan’s Bay Community** – Following our meeting with the Mayor and her team on 16<sup>th</sup> March, during the subsequent two days (17<sup>th</sup> and 18<sup>th</sup> March 2022) community engagement meetings were held at the Community Centre of Susan’s Bay, which were facilitated by the Councillor of the Ward (Cllr. Madinatu Kamara) and supported by Mr. Yirah Conteh who is the Chairman for a local slum dweller association called FEDURP.



**Photos 26 & 27:** Councillor and Participants at Susan’s Bay Community Engagement |

**Source:** ENACT Project Team (Mach 2021)

The objective of the community engagement meetings was to ensure community participation, inform community leaders and influencers of the ENACT Project, provide a brief on the Feasibility Assessment (including field surveys that will be conducted by Project Partners (ILEM- Africa, PayGas, and AfriGas) on access to clean cooking for the people in Susan’s Bay. Unlike the other two for-profit private sector companies on this project exercise (AfriGas, and PayGas) promoting the use of LPG for cooking, ILEM-Africa’s approach on the conduct of this Feasibility Assessment focused on analyzing existing cooking culture and proffers options from traditional biomass-based cooking fuel to improved cook stove using briquettes produced from agricultural residues to an eventual transition modern energy cooking service. Adopted approach provided an insight on how Susan’s Bay community access cleaner cooking energy.



**Photos 28, 29 & 30:** ILEM-Africa demonstrating the pathway to clean cooking energy transition from biomass to improved cookstove using briquettes | **Source:** ENACT Project Team (Freetown, Mach 2021)

**8.2. Mapping of Stakeholders (Households, SMEs/Micro Enterprises, ESPs)** – Engagement with stakeholders helped to categorize the different layers and actors in the cooking energy value chain sector. This exercise helped to define the construct of **end-users of energy cooking services** (i.e., *Households, SMEs/Micro Enterprises*) and the **cooking energy service providers** (i.e., *Cookstove producers/dealers, Firewood-Charcoal suppliers/sellers, LPG distributors/dealers*). The following facts were ascertained on the stakeholder groupings.

**8.2.1. Households** According to a Report from CODOHSAPA there are about **1,566 households**<sup>17</sup> in Susan’s Bay, making it one of the largest seaside informal settlements in Freetown. During this Feasibility Assessment, it was observed that **84%** of the households interviewed were engaged in some sort of micro businesses include local fast - food, restaurants, tea shop etc.

**8.2.2. MEs/Micro Enterprises** From our field assessment, it was observed that there are **84% households** from the 163 households are in some sort of SMEs/Micro Enterprise businesses, which include local restaurants, cafés in Susan’s Bay community.



**Photo 31:** A local café owner in Susan’s Bay community |  
**Source:** ILEM-Africa on ENACT Project (Freetown, March 2022)

**Photo 32:** Isatu Kamara, a local restaurant owner in Susan’s Bay |  
**Source:** ILEM-Africa on ENACT Project (Freetown, March 2022)



<sup>17</sup> According to finding in March 2021 by Centre if Dialogue on Human Settlement and Poverty Alleviation (CODOHSAPA)

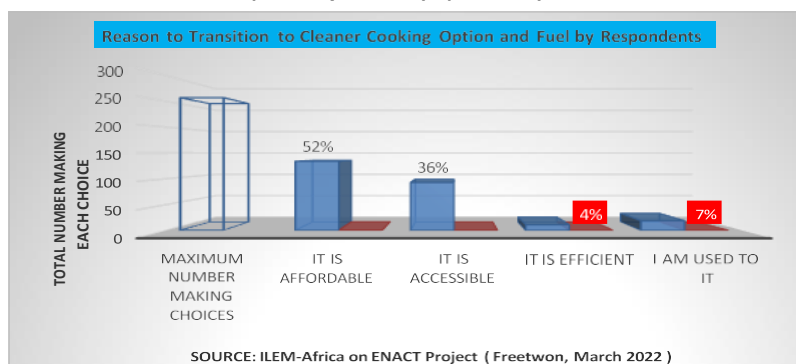
**8.2.3. Cookstove Producers/Dealers** There were no cookstove producers and dealers found within Susan’s Bay community. During the field investigation, it was observed that most people buy their Unlined Metal Cookstove and Unfired Clay-Lined Cookstove from a nearby slum community called Kroo Bay which is about 950.0m away and from mobile vendors from Fourah Bay Market (1.5km), and Kroo Town Road Market (1.3km).

**8.2.4. Firewood Suppliers/Dealers** There are about **45 firewood suppliers and sellers in the Susan’s Bay community**. It was observed that all of the firewood wholesalers do retail-selling, with selling points are scattered in the community. **See photo 17.**

**8.2.5. Charcoal Dealers** There are about **92 wholesalers of charcoal retailers in the Susan’s Bay community**. It was observed that almost all households are into retailing charcoal in the community. **See photos 18, 19 and 20.**

**8.2.6. LPG Distributors and Dealers** It was observed that the two LPG suppliers in Sierra Leone have no distribution or selling points at Susan’s Bay. We also observed that there is only 1 micro business man who has 6kg LPG cookstove, which he uses to make a local tea called “Ataya” as indicated in **Photo 21** of this Report.

The general observation from our assessment at Susan’s Bay community is that households and micro business are willing to use cleaner cooking options (LPG, ICS and briquettes) if they primarily affordable and accessible, as indicated in **Figure 8** below.



**Figure 8:** Reasons and expressed willingness of Susan’s Bay community to transition into cleaner cooking options | **Source:** ILEM-Africa (Freetown, April 2022)

## IX. CHALLENGES ON ACCESS TO CLEAN COOKING SERVICES IN SUSAN'S BAY

In an effort to guarantee access to energy for industrial development and clean cooking for domestic use, in September 2015, the United Nations and world leaders agreed on setting a global development goal (SDG-7) to "Ensure access to affordable, reliable, sustainable and modern energy for ALL". While the SDG-7 presents targets for global access to energy services, this assessment reveals that communities like Susan's Bay have infrastructural challenges. In the context of this Report<sup>18</sup>, we framed identified challenges at the level of **Demand Side** (i.e., end-users of cooking energy services); **Supply Side** (i.e., cooking energy service providers); and **Governance Framework** (i.e., policy and legal regulatory instruments).

**9.1. Demand Side** (i.e., end-users of cooking energy services) – We streamed challenges at demand side of cooking energy services from end-users by grouping views on transitioning from traditional cooking options and fuels to improved and modern energy cooking services:

**9.1.1 Cooking Options** As highlighted in Figure 8, it was observed from our survey that of the population is willing to transition from existing cooking means ( *Traditional 3-Stone; Unlined Metal Cookstove, and Unfired Clay-Lined Cookstove*) to clean cooking technologies namely, ICS, LPG, and or briquettes from agri- residues/wastes if they are **affordable (52%)** and if they are **accessible (36%)**.

<sup>18</sup> Feasibility Assessment on Access to Clean Cooking Solutions for Susan's Bay community

Below matrix provides comparison on costs<sup>19</sup> of existing cooking means and proffered cleaner cooking option (*Ceramic Insulated Improved Cookstove-ICS*).

**Table-5:** Cost of existing cooking means and proffered cleaner cooking option for Susan's Bay community

<b>Existing Cooking Means (cost comparison)</b>			
<b>Type</b>	<b>Durability</b>	<b>Purchasing Cost</b>	<b>Annual Cost</b>
- <b>Traditional 3-Stonefire</b>	5 years, if ingenious stone is used	N/A	N/A
- <b>Unlined Metal Charcoal Cookstove</b>	4 months	Le. 90,000.00 i.e., <b>US\$ 6.9</b> single burner Le. 240,000.00 i.e., <b>US\$ 18.5</b> twin burner	Le. 270,000.00 <b>US\$ 20.7</b> Le. 720,000.00 <b>US\$ 55.4</b>
- <b>Unfired Clay-Lined Cookstove</b>	4 months	Le. 50,000.00 <b>US\$ 3.9</b>	Le. 150,000.00 <b>US\$ 11.6</b>
- <b>Wire-Mesh Cookstove</b>	2 months	Le. 15,000.00 <b>US\$ 1.2</b>	Le. 90,000.00 <b>US\$ 6.9</b>
- <b>Kerosene Cookstove</b>	3years	Le. 150,000.00 <sup>20</sup> <b>US\$ 11.6</b> single burner	Le. 50,000.00 <b>US\$ 3.9</b>
<b>Proffered Cleaner Cooking Option (indicative cost)</b>			
- <b>Ceramic Insulated Improved Cookstove (ICS)</b>	Minimum of 2years (with repair warranty after 2years of use of TERANGA cookstove product administered by ILEM-Africa)	Le. 500,000.00 i.e., <b>US\$ 39.5</b> single burner Le. 1,200,000.00 i.e., <b>US\$ 92.4</b> twin burner	Le. 250,000.00 <b>US\$ 19.25</b> Le. 600,000.00 <b>US\$ 46.2</b>

**Table-5** above provides an insight on cost for existing cooking means and proffered cleaner cooking option. Analysis of purchasing price, monthly usage, and accumulated annual costs give us a comparative understanding that although the *Unlined Metal Charcoal Cookstove*, which is widely used and accounts for **59%** end-users in Susan's Bay, it is more expensive as the annual costs are **US\$ 20.7 for single burner** and **US\$ 55.4 for twin burner**, whereas ILEM-Africa's proffered cleaner cooking option (*Ceramic Insulated Improved Cookstove-ICS*) costs **US\$ 19.25 for single burner** and **US\$ 45.2 for twin burner**. This implies that if introduced, ICS is an affordable cleaner cooking option, as the **payment method makes provision for end-users in Susan's Bay community to access cleaner cooking option based on their preferred payment method**.

<sup>19</sup> The cost value is pegged in Leones to US\$ at exchange rate of Le. 13,000.00 to US\$ 1, and estimated cost is as of 19<sup>th</sup> June 2022

**9.1.2 Cooking Fuels** Although briquettes and LPG are not widely in use in Susan's Bay community, **52% of respondents expressed desire** to want to use **cleaner cooking fuel (briquette) if payment scheme is affordable**. Below matrix provides comparison on costs of existing biomass cooking fuels (*charcoal, firewood and LPG*), and proposed cleaner cooking fuel (*briquette*).

Table-6: Cost of existing cooking fuels and proffered cleaner cooking fuel for Susan's Bay community

Existing Cooking Fuels ( <i>indicative cost</i> )				
Type	Package	Weight	N <sup>o</sup> of Meals/Cook	Cost
- <b>Charcoal</b>	50kg rice bag	20kg – 25kg	10 – 12 meals for a family of 3-5persons, and could cook one 50kg bag of rice for 100 persons	Le. 60,000.00 <b>US\$ 4.7</b>
	Medium size polythene bag	3kg	2 meals for a family of 3-5persons	Le. 5,000.00 <b>US\$ 0.38</b>
	Small size polythene bag	1kg	1 meal for a family of 3-5persons	Le. 2,000.00 <b>US\$ 0.15</b>
- <b>Firewood</b>	Bundle of 12 pieces of <b>mangrove wood</b>	Weight depends on the size of the pieces	1 meal for a family of 3-5persons	Le. 10,000.00 <b>US\$ 0.77</b> (During the dries) Le. 15,000.00 <b>US\$ 1.15</b> (During the rains)
	Bundle of 12 pieces of <b>other type of wood</b>	Weight depends on the size of the pieces	2 bundles would be required to cook 1 meal for a family of 3-5persons	Le. 7,000.00 <b>US\$ 0.45</b> (During the dries) Le. 10,000.00 <b>US\$ 0.77</b> (During the rains)
- <b>LPG</b>	Steel Canister	6kg	Depending on frequency of usage	Le. 140,000.00 <b>US\$ 10.77</b>
Proffered Cleaner Cooking Fuel ( <i>indicative cost</i> )				
- <b>Briquette</b>	Big size bag	10kg	10 meals for a family of 3-5persons	Le. 80,000.00 <b>US\$ 6.15</b>
	Medium size bag	5kg	5 meals for a family of 3-5persons	Le. 40,000.00 <b>US\$ 3.08</b>
	Small size bag	1kg	1 meal for a family of 3-5persons	Le. 8,000.00 <b>US\$ 0.62</b>

<sup>20</sup> Since Kerosene cookstove last for 3years, to have the annual cost, it has to be dived by 3

**Table-6** provides an insight on cost for existing cooking fuels and proffered cleaner cooking fuel option (*Briquette*). The analysis of purchasing price, daily usage, number of meals it would cook, and costs give us a comparative understanding that although biomass cooking energy fuels (*Charcoal and Firewood*) are widely used accounting for 98% end-users in Susan's Bay community. Our cost analysis on **Table-6** indicates for example that the price for **1kg charcoal** is Le. 2,000.00 i.e., **US\$ 0.15**, whereas 1kg briquette is Le. 8,000.00 i.e., **US\$ 0.62**. This implies that the price margin is only **US\$ 0.47**. From our field survey **47% of our respondents said that the use of firewood and 57% alluded that the use of charcoal are major sources of health problems**, while **73% indicated that they cause environmental problem**. Knowing the health and environmental implications of using biomass as cooking fuel, there is an apparent community desire in Susan's Bay to explore a cleaner cooking fuel if payment scheme is tailored to their purchasing power, they would afford cleaner cooking fuel. During this Feasibility Assessment, discussions with TERANGA, FINIC, and Rugsal enterprises underpinned some of the challenges on the **demand needs** for clean cooking products summarised as follow:

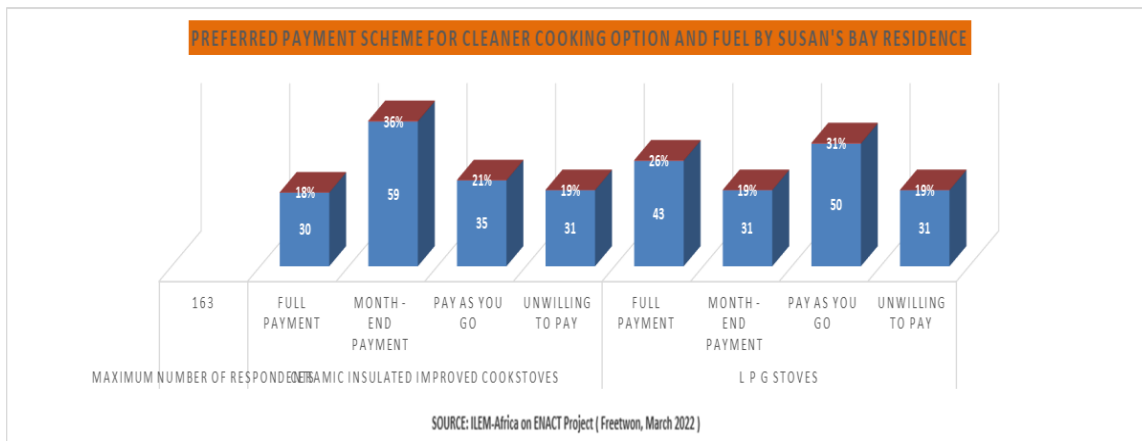
**9.1.3 *Safety*** It was observed during the survey that **63%** of the respondents said that existing cooking means cause **headache**. The conclusion is that end-users need to be informed about the health benefit using ICS and Briquette, which current clean cooking service providers acknowledged they are not providing.

**9.1.4 *Partnership and Investment*** Cooking energy service providers ILEM-Africa met during this assessment relate that limited partnership and lack of financial investment in the sector, is making it difficult to scale-up production of ICS and briquettes, meet the pricing level, and supply to end-users in Susan's Bay.

**9.2. Supply Side (i.e., cooking energy service providers)** – During the conduct of the "Feasibility Assessment", ILEM-Africa looked beyond its own ICS producing entity (TERANGA), and we visited other cooking energy service providers (namely, FINIC, Rugsal, SAMBA Enterprise, and WIESL) to determine the challenges they face selling/supplying their clean cooking technologies (namely ICS, and briquettes). Challenges were identified and clustered on issues related to **Access** Susan's Bay, **Safety** at the level of distributors, and **Awareness** on the use of ICS products in Susan's Bay and other informal settlements:



9.2.1 Access During the conduct of this assessment, 36 households (i.e., 22% respondents) indicate that lack of **access**; 102 household (i.e., 63% respondents) indicate **affordability**, create strain to access ICS, briquette, and LPG in Susan’s Bay. It was noted that if clean cooking technologies and products are affordable with a payment scheme for clean cooking products to be accessible drawn from PayGas<sup>21</sup> proposal of Pay-As-You-Go system, people in Susan’s Bay would switch to cleaner cooking option.



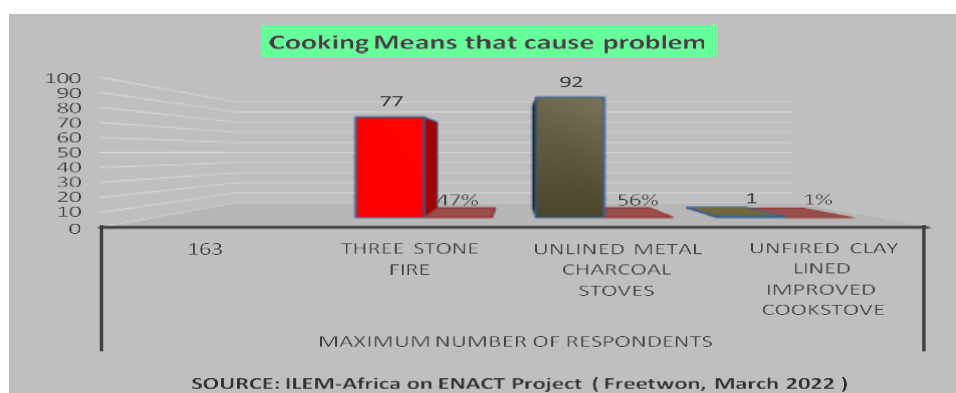
**Figure -9:** Preferred payment scheme for access to ICS and LPG | **Source:** ILEM-Africa (April 2022)

The payment scheme in **Figure-9** outlined affordable means residents of Susan’s Bay community would want to use to pay for access of cleaner cooking options and fuels. Based on respondents’ suggestive payment scheme, business models are tailored-designed to make cooking energy accessible in Susan’s Bay community. Proposed Business Models are outlined in the Pilot Project Implementation Plan of this Feasibility Assessment Report.

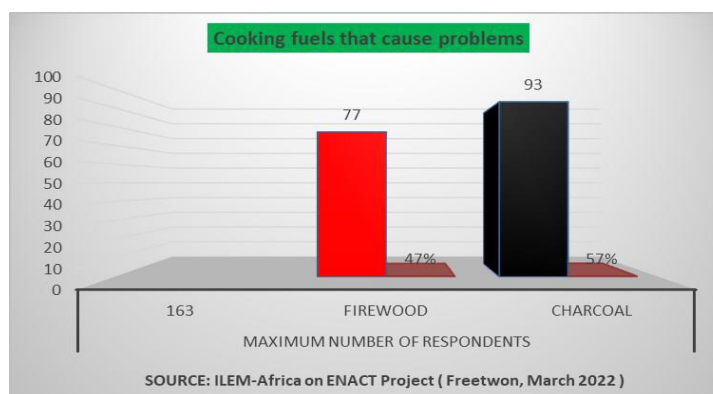
9.2.2 Safety On proposed idea to introduce the LPG Pay-As-You-Go scheme, there would be need to build a refilling infrastructure along the harbor, which is less congested. To set-up proposed LPG refilling infrastructure, there is need fundamentally to raise awareness on LPG and sensitize on its use and storage, as we noted from this assessment study that about 45 households of 163 i.e., 28 % have limited knowledge about LPG. This approach would address any future unforeseen fire incident that would/might be caused by LPG handling.

<sup>21</sup> PayGas is a South African-based company providing affordable LPG cooking option for Low Income Households

**9.2.3 Awareness Raising** Deduced from our field assessment during the conduct of this study, it is noted that about **47% of our respondents said that the use of firewood and 57% alluded the use of charcoal are major sources of health problems**, while **73% indicated that its cause environmental problem**, and **63% mentioned that headaches are caused as result of exposure to Household Air Pollution (HAP)**. See **Figures 6 and 8** of the Report with illustrating our findings. Ultimately, there is need to raise awareness on associated risks related to using traditional cooking options and fuels, and advocacy campaign on the advantage to transition to cleaner cooking energy options. Public awareness through the different media outlets (print, television and dramas) has the propensity to influence and widely accept of cleaner cooking solutions.



**Figure -10:** Perception on how exiting cooking means cause health and environmental problems | **Source:** ILEM-Africa (April 2022)



**Figure -11:** Perception on how exiting biomass cooking fuels cause health and environmental problems | **Source:** ILEM-Africa (April 2022)

**9.3. Governance Framework (Policy and Legal Regulatory Instruments)** – In our analysis of overarching policies and programmes of actions on clean energy for cooking (**depicted in Tables/Matrices 1 and 2**) of this report, this Feasibility Assessment outlines the *State of Play of the Cooking Energy Regime in Sierra Leone and particularly in Susan’s Bay community*. The number of formulated upstream policies and efforts towards implementing downstream programmes addressing cooking energy needs in Sierra Leone, is indicative that there is a strong political will to reform the use of biomass energy fuel (firewood and charcoal) for cooking to the use of bioenergy and LPG for cooking considering. Existing policy and programming strength is an enabler for reform; for example, the review of the 1972 Wildlife and the 1988 Biodiversity Acts which levied a fine of Le. 5.00 (which is approximately \$ 0.0004) for encroachers of forest reserve and biodiversity. The current insignificant fine does not deter the rapid deforestation for the production of biomass. Hence, the need for a legal regulatory framework and punitive measures for deforestation and charcoal production.

To help with the translation of policy framework to scale-up project and programme interventions on access to clean cooking solutions, as recent as **10<sup>th</sup> May 2022**, the Ministry of Energy of the Government of Sierra Leone requested the global Clean Cooking Alliance (CCA) to help with the establishment of **Clean Cooking Delivery Unit Network (DUN)** with the Ministry of Energy. The objective of the Clean Cooking DUN is meant to help coordinate national efforts and mobilise the political leadership needed to address transitional and clean cooking energy access in Sierra Leone, focussing primarily on rural and slum communities. At governance level, this initiative including ENACT/ICLEI and Energy 4 Impact supported assessment on clean cooking solution for Susan’s Bay community will inform the operationalisation of the pilot initiatives by investing grants and zero-interest loan to capacity building companies like ILEM-Africa and cookstove producing entity like TERANGA and our network of clean cookstove producers across Sierra Leone to facilitate the deployment of clean cooking options for low-income households and communities like Susan’s Bay. Direct investment on sustainable clean cooking solution has the propensity to have both short and long-term impact on the lives of people and the environment.

## X. KEY FINDINGS AND RECOMMENDATIONS

In our effort to respond to challenges on access to clean cooking options in Susan's Bay community, field Findings and tailor-designed recommendations will inform and guide the implementation of any programmatic intervention geared towards addressing perceived systemic barriers to access to clean cooking solutions.

### 10.1. Findings – Herein are 13 observations made during the conduct of this assignment:

**10.1.1** *It was observed that as of October 2020 at national level, Sierra Leoneans use about **72% of Sierra Leonean use firewood** and over **27% use charcoal** for cooking. This implies that **99% of cooking energy comes from biomass** (firewood, and charcoal) making Freetown a graveyard for the forest reserve which continues to rapidly shrink to meet the demand for biomass cooking energy sources.*

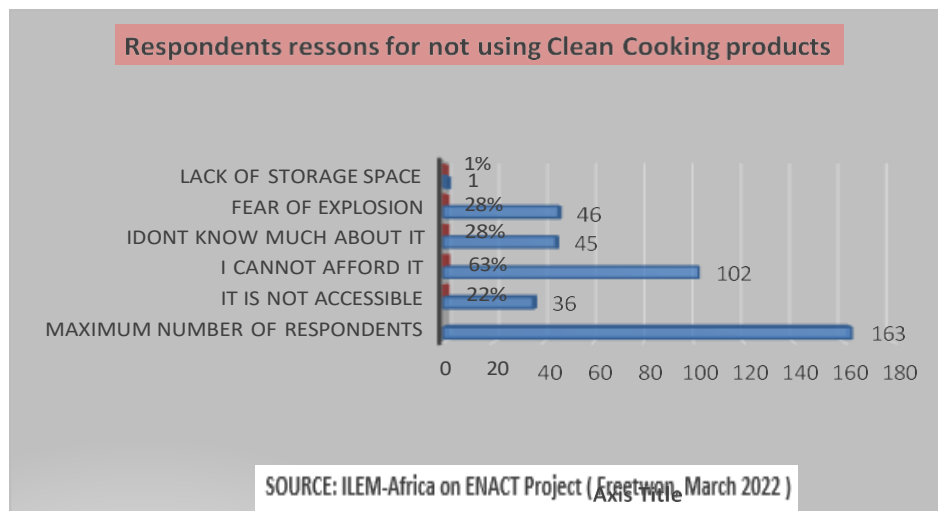
**10.1.2** *At community level, as there is no access to alternative cooking energy it was observed from our survey conducted in Susan's Bay that **83%** use charcoal, and **15%** use firewood for cooking. As such, biomass energy (**98%**) is the dominant cooking energy fuel in Susan's Bay community.*

**10.1.3** *It was observed that there are different layers in the Value-Chain on the production and marketing of firewood and charcoal. This means that many people are involved in the biomass energy sector as sources of livelihood.*

**10.1.4** *Before the use of LPG as cooking fuel in Sierra Leone, kerosene was the petroleum product used. Over the years kerosene cookstove users have switched to LPG. It was noticed that at Susan's Bay there are about **0.6%** users of kerosene and same number of users of LPG in the community.*

**10.1.5** *It was discovered that there is only 1 household using kerosene as cooking fuel.*

- 10.1.6 *There are only two LPG suppliers in Sierra Leone, namely AfriGas (importer and distributor of LPG for cooking), and the NP (National Petroleum importer and distributor of petroleum product including LPG for cooking).*
- 10.1.7 *Due to reasons related to safety, access and affordability, it was observed no household owns or uses LPG canister/cookstove, except 1 micro businessman who has a 6kg LPG cookstove which he uses to make a local tea called “Ataya”.*
- 10.1.8 *We noted that affordability, accessibility and safety concern pose the real challenge of people in the Susan’s Bay community to use clean cooking products like ICS, LPG and briquettes. **Figure 12** below highlights concerns preventing residents in Susan’s Bay from using clean cooking products.*



**Figure -12:** Concerns preventing the use of LPG in Susan’s Bay community | **Source:** ILEM-Africa (April 2022)

- 10.1.9 *It was recorded that about **76% of households** in Susan’s Bay choose to use either Unlined Metal Cookstove (59%), and or Unfired Clay-Line Cookstove (16%) as their primary means for cooking because it is accessible (readily available) and affordable (cheaper). Those that cannot afford these cooking options resort to using the Traditional 3-Stone for cooking (amounting to 23%).*

**10.1.10** In our analysis of overarching policies and programmes of actions on clean energy for cooking (**depicted in Tables/Matrices 1 and 2**) of this report, this Feasibility Assessment outlines the *State of Play of the Cooking Energy Regime in Sierra Leone and particularly in Susan's Bay community*. There are number of formulated upstream policies and efforts towards implementing downstream programmes addressing cooking energy needs in Sierra Leone, which is indicative that there is a strong political will to reform the use of biomass energy fuel (firewood and charcoal) for cooking to the use of bioenergy and LPG for cooking considering. Existing policy and programming strength is an enabler for reform, for example the review of the 1972 Wildlife and the 1988 Biodiversity Acts which levied a fine of Le. 5.00 (which is approximately \$ 0.0004) for encroachers of forest reserve and biodiversity.

The current insignificant fine does not deter the rapid deforestation for the production of biomass. Hence, the need for a legal regulatory framework and punitive measures for deforestation and charcoal production. And to help with the translation of policy framework to scale-up project and programme interventions on access to clean cooking solutions, as recent as **10<sup>th</sup> May 2022**, the Ministry of Energy of the Government of Sierra Leone requested the global Clean Cooking Alliance (CCA) to help with the establishment of **Clean Cooking Delivery Unit Network** (DUN) with the Ministry of Energy.

**10.1.11** *From our survey statistics, 87% of the total respondents were female, proving that they are the ones mostly doing the cooking in both households and food-based SME's. Hence, they can be major players in adopting the transition from the traditional means of cooking to an improved and cleaner means of cooking.*

## 10.1. Recommendations– Herein are 9 actions proffered for ENACT Partners to consider:

10.1.1 Community Sensitization – As indicated from this assessment **47% of our respondents said that the use of firewood and 57% alluded the use of charcoal are major sources of health problems**, while **73% indicated that they cause environmental problems**, and **63% mentioned that headaches are caused as result of exposure to Household Air Pollution (HAP)**. There is need therefore to conduct a demonstration exercise on the use of ICS and briquettes and LPG in the community. The net outcome will improve peoples’ acceptance and appreciation of proposed cleaner cooking technology for their wellbeing, and environmental safety.

It should be noted that 87% of the total respondents were female, for behavioral change to take effect on women, girls and children who spend most time around cooking area and thus most vulnerable to HAP exposure and should therefore be the target beneficiaries and having them play a role as peer trainers/sensitizers. This would require having women-focused trainings on cooking fuel and proper handling of clean cookstoves and fuels.

10.1.2 Scale-Up Distribution of ICS – This report has established that there are clean cookstove producers across the country and in a nearby community of Susan’s Bay (Kroo Bay). **What is needed to ensure deployment and gradual transition from existing cooking means to clean cooking option, would require increased sensitization on cleaner cooking options** that are available.

10.1.3 Invest on Briquette and Pellet Production – The proposed clean cooking technology by ILEM-Africa through TERANGA with support from FINIC is required to scale-up production of ICS, briquettes and pellets from agri-waste to replace biomass cooking energy. Hence the **need for grant investment to make clean cooking products accessible and affordable in Susan’s Bay community**.

- 10.1.4** Provide Alternative Livelihood for Biomass Energy Dealers – Given that the different layers in the Value-Chain-Market on the production and market-line of firewood and charcoal involves the livelihood of people and with 58% expressing willingness to market cleaner cooking solutions. This means there is willingness of local biomass energy dealers to engage in the value-chain and deployment of clean cooking options in Susan’s Bay community.
- 10.1.5** Setting-Up of a Low-Income LPG Re-filling Point/Station – To ensure safety concern on access to LPG Pay-As-You-Go scheme, ILEM-Africa would recommend the building of a refilling infrastructure by the harbor, which is less congested. There would also be need to train/sensitize households on the use and storage of LPG cookstove to reduce the risk of any unforeseen fire incident.
- 10.1.6** Financial Support of a Business Model – For the implementation of a pilot project on access to clean cooking solutions, ENACT should consider supporting Business Models proposed by ILEM-Africa through grants or zero-interest loan for the deployment of clean cooking products for low-income households in Susan’s Bay. During the conduct of this Assessment, ILEM-Africa discussed with a pro-poor Microfinance Institution called Munafa which operates in about 40 vulnerable communities in Western urban and rural<sup>22</sup> (including Susan’s Bay) with over 9,000 beneficiaries. ILEM-Africa’s Business Model could be supported by Munafa’s existing financial services (loan, and savings), coupled with its non-financial services (socio-economic training and social counselling). Munafa works with vulnerable and underserved communities which are distrusted and therefore excluded from the formal financial system by removing several barriers including the need for collateral, guarantee, and guarantor.

<sup>22</sup> Including Susan’s Bay, Munafa operates in the following deprived communities namely Goderich (Funkia), 7 -Barralion, Crab Town, Pottor, Kailahun Court Barrie, Adonkia, Kaningo, Fonima, Madongo Town, Cockle Bay, Susu Village, Dwazarck, Mabella, CPO Wharf, Kroo Bay, Tengbe Town, Oloshoro, Congo/Kolleh Town, Grey Bush, Cassel Farm, Cobalt, Kanikay, Black Hall Road, Leicester Road, Moa Wharf, Waterloo, Bolima, Boufla.



Some of the appealing features of Munafa is that it offers 2% monthly interest rate and even has a special loan product for extremely vulnerable people which offers a reduced loan amount at 1% monthly interest rate. The monthly interest rate of most other MFIs range between 2.5% to 3.5%. Secondly, Munafa levies zero interest for default on loan installment whereas most MFIs levy very high penal rates (some as high as 1% for each day the loan is in default). Thirdly, Munafa's promoter- the French NGO, Entrepreneurs du Monde- is an active promoter of clean and renewable energy in all the entities it incubates in three continents around the world.

- 1.1.1 *Monitoring and Evaluation of Pilot Project*** – To ensure value for money in any direct investment on existing business to expand or to support an innovative business model on clean cooking, there is need to conduct quarterly monitoring of planned activities and evaluate project performance and impact on social wellbeing, peoples' health and contribution to the reduction of CO<sup>2</sup> emission.

## **XI. PROPOSED CLEAN COOKING TECHNOLOGIES**

Based on the outcome of this assessment on access to clean cooking energy options in Susan's Bay community, we have a clearer insight on the state of play of cooking energy regime in Susan's Bay. During this assessment, we identified **6 means of cooking** (i.e., *Traditional 3- Stonefire; Unlined Metal Cookstove; Unfired Clay-Lined Cookstove; Wire-Mesh Cookstove; LPG Stove; and Kerosene Stove*), and **4 cooking fuels** (i.e., *Charcoal; Firewood; Kerosene, and LPG*). **Chapter VI** of this Report provides detail "Analysis of Existing Cooking Options and Fuels in Susan's Bay" with referenced statistics drawn from our field survey. Noting that there are fundamental challenges on access to clean and affordable cooking solutions for low-income households, based on field investigation and information derived from conducted Feasibility Assessment and Field Visits, ILEM-Africa intends to seek support from ENACT to address clean cooking challenges in Susan's Bay, by investing on the following cleaner cooking technologies:

**11.1. Transitional Clean Cooking Option (Ceramic Insulated Improved Cookstove-ICS)** – ICS are designed in circular and square shaped made of 1.5mm thick mild steel sheets which are bended and welded together with an insulated ceramic in the upper combustion chamber. They are mostly portable, but having ceramic as the internal lining and made of thicker mild steel sheets makes them a little heavier. They generally have single burners ranging from small, medium and large. They also have twin burners mounted on stands, which add value on being improved and modern cooking option. The ceramic insulated ICS contain a closed compartment with a slot at the lower side where a removable ash collection tray is inserted.



Photos 33, 34, & 35: Illustrating Single and Twin ICS Burners produced by TERANGA Cooking Stove Cottage Industry | Source: ILEM-Africa(Freetown, March 2022)

The ceramic insulated ICS have the option to regulate the rate at which they burn fuel with the creation of an opening that can be shut depending on the need for more or less air. Most have a foldable or removable pot-rest creating a small gap between the burning fuel and the pot, so the pot does not sit directly on the fuel. Because air supply can be regulated, the heat radiated to the sides that are ceramic insulated is mostly deflected towards the top where the pot is placed and because the bottom compartment is mostly closed heat radiated to the bottom is deflected back toward the pot resulting in reduction in waste of cooking fuel and less fuel is spent. These features make this cookstove much more energy efficient than the existing cooking options in Susan's Bay (i.e., Traditional 3-Stonefire, Unlined Metal Cookstove, and Unfired Clay-Lined Cookstove). As the amount of cookstove required for Susan's Bay is below 3,000,00, ILEM-Africa will therefore work with its ICS producing entity TERANGA in implementing proposed intervention in Susan's Bay. And if there is need to mobilize additional support in the implementation of a country wide project/programme, ILEM-Africa will mobilize support from other cookstove producers' entities (SAMBA Enterprise, etc. WIESL) with whom ILEM-Africa has a long-term collaborative partnership agreement.

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The **cost for single burner ranges from Le 300,000/US\$ 23.07 to Le.500,000/US\$ 38.46 (depending on the size) and the twin burner cost Le 1,200,000/US\$ 92.30**. While they cost more than other cookstove, it should be noted that they last longer and burn less cooking fuel which provides a long term financial off-set. Compared to existing cooking options, the ceramic insulated ICS produced by TERANGA in addition to their fabrication quality and fuel-efficiency, they are built to use charcoal, briquettes, pellet from agri-waste (briquette) emitting no toxic smoke and are energy efficient. This proposed cooking technology is therefore considered from our field survey to be the most effective clean cooking solution for Susan's Bay community. With possible support from ENACT and its partners, ILEM-Africa through TERANGA cookstove industry will deploy its ICS energy-efficient cookstove in Susan's Bay community, thereby making sustainable clean cooking product accessible for households in Susan's Bay and in other energy poor communities in Sierra Leone.

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**11.2. Clean Cooking Fuels (Agri-Residue Cooking Fuel, Low Income LPG, and E-Cooking)** – In our analysis of existing cooking fuel used in Susan’s Bay, it is apparent that households and businesses rely heavily on Biomass for cooking energy. We found-out that **83% use charcoal**, and **15% use firewood** for cooking in the community. **This represents 98% use of biomass fuel for cooking in Susan’s Bay.** In a bid to change this narrative from dirty cooking to cleaner cooking fuel, ILEM-Africa, would recommend the use of proposed cooking fuels.

**11.2.1. Agri-Residue Cooking Fuel** Is an **innovation to save the forest** by transforming agricultural wastes (*i.e., palm kernel shell, coconut pod, rice husk, corn cobs, black eyed beans shell, elephant grass shrubs, etc.*) into carbonized briquettes and pellets as alternative to charcoal and firewood for cooking. With agro-residues wasting in thousands of tons across the country, while ILEM-Africa already has a its own ICS producing entity and has a long-term “*Partnership Agreement*” with other cookstove producers across the country,

ILEM-Africa has also formalized "Partnership Agreement" with an indigenous small-scale industry called Formel Industries and National Industrialization Centre-FINIC to invest into a large-scale production of briquettes and pellets from agricultural wastes to replace the use of charcoal and firewood in Susan's Bay community and eventually roll-out a national programme with support from ENACT and other potential partners. ILEM-Africa's choice of FINIC over Rugsal is because of the quality of briquette FINIC produces is cleaner, energy efficient, and emit no smoke as observed during this assessment.



Photos 36, 37, 38 & 39: ILEM-Africa Field Visits at FINIC briquette transforming site | Source: ILEM-Africa (F/Town, March 22)

To illustrate viability of this initiative, we conducted Field Visits to FINIC at Kissy (6.1km from Susan's Bay), and Rugsal Trading at Foya Village, Newtown (39km from Susan's Bay). Our Feasibility Assessment findings indicate that the value of **2kg of rice husks for example is equivalent to the heat released from 1 liter of diesel**. It is estimated that **annually Sierra Leone produces 600,000 tons of rice. 20% of rice produced is husks which is about 120,000 tons**. When processed, it produces about 24,000 tons of carbonized coal in the form of briquette that gives 1,200 bags of 20kgs. And compared to charcoal, the price is 1gk=Le 8,000|**US\$ 61.00**; 5kg=Le 40,000|**US\$ 3.07**; and 10kg=Le 80,000|**US\$ 6.15**. Unfortunately, agricultural residues are presently left to rot across the country.

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ILEM-Africa will be working with FINIC to transform agri-waste into briquettes in an effort to reducing deforestation for the production of biomass cooking fuel. **See Table-6 on costs of cooking fuel.** To this end, ILEM-Africa has secured “*Partnership Agreement*” with FINIC to scale-up investment on the production of “*Agri-Residue Cooking Fuel*” cleaner cooking option for Susan’s Bay community, as FINIC is only now producing briquette for selective few/middle class not for slum community. This would require scaling-up briquette production at TEARNDA and FINIC to meet the need of slum communities and other rural settled. Below is an outline of the **5 processing stages for the transformation of agro-wastes into clean energy carbonized charcoal** in the form of briquettes:

1. **Carbonization** – burning agri-waste in a drum with very little or no oxygen.
2. **Pulverization** – crushing the carbonized waste into powder using a hammer-mill.
3. **Blending** – mixing the pulverized waste with a binding agent (starch from cassava) then the mixture is poured into a presser, where it is pressed manually.
4. **Extrusion** – using a fast manual pressing machine, an extruder is attached to the presser shape through which the soft briquettes come out and it is cut into pieces. For every extrusion 21 pieces are ejected with daily production of 50 bags of 20kg.
5. **Drying** – drying is the final process using sun-done and or mechanized dryer for commercial production which last for 8 hours.

The economics and ILEM-Africa’ proposed Business Model for transforming and marketing agri-residue as cooking fuel in the form of briquettes and pellets in a bid to move away from charcoal and firewood for cooking in Susan’s Bay community is defined in our Pilot Project Implementation Plan for consideration by ENACT Project Management Team.

**11.1.1. Low Income LPG** – As earlier noted, there are only two LPG suppliers in Sierra Leone, namely AfriGas, and the NP. The pressurized steel LPG cylinder is also mostly doubled as the cookstove with a removable burner installed at the top. The LPG used in Sierra Leone are Butane gas filled in 6kg, 12kg, and 54kg canisters, and the refilling cost for the different sizes are as follow 6kg=Le 140,000|**US\$ 10.76**; 12kg=Le 280,000|**US\$ 21.53**; and the 54kg=Le 1,230,000|**US\$ 94.61**.

While conducting this Feasibility Assessment in Susan’s Bay, it was observed that almost none of the households and businesses own LPG canister/cookstove, except 1 micro businessman who has a 6kg LPG cookstove which he uses to make a local tea called “Ataya”, this represents **0.6% of LPG users in Susan’s Bay**. The use of LPG for cooking at national level is estimated to be **0.99%**. The reason of having a reduced number of **LPG** users for cooking is due to the initial investment cost and refilling model which *necessitates paying for a minimum of 6kg which is a natural barrier access of LPG for cooking*. To change this narrative, households and businesses in Susan’s Bay community indicate that they could afford LPG if the payment scheme is affordable. Given the low- income level of people in Susan’s Bay community, to address the purchasing limitation and to make LPG affordable for end-users, there is need to draw from PayGas<sup>23</sup> refilling model which provides *affordable LPG for cooking for low-income households called Pay-As- You-Go system*.

For Susan’s Bay to have access to LPG for cooking, PayGas may have to partner with AfriGas and NP and create a refilling infrastructure in the community, ideally by the harbour which is less congested and households and business owners trained to use and store their LPG to avoid fire incident that might be caused by LPG handling. In addition to the safety concern, building LPG infrastructure would likely need more time and resources.

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<sup>23</sup> A South African-based company providing affordable LPG cooking option for Low Income Households

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Cognisant that in the conduct of this “*Feasibility Assessment on Access to Clean Cooking Solutions for Susan’s Bay Community*”, ENACT and its implementing partners recruited two other for-profit private sector LPG companies (namely AfriGas, and PayGas) in addition to ILEM-Africa for the conduct of this assignment. We are therefore confident that AfriGas and PayGas have the expertise to define the economics for providing access to LPG for low in-come households and micro enterprise in Susan’s Bay community to and are able to proffer a Project Implementation Plan on access to LPG to the ENACT Project Management Team.

**11.1.2. E-Cooking** – As there is currently no proper electricity connection in Susan’s Bay observed during this study, the use of electricity for cooking therefore is a long-term objective. With only 20.3% electricity access in Sierra Leone, E-Cooking is a therefore a futuristic option for rural and impoverished communities like Susan’s Bay. Having outlined available options, opportunities and challenges on access to clean cooking, it is prudent to conclude that investment in **Transitional Clean Cooking Option** (Ceramic Insulated Improved Cookstove), and on **Clean Cooking Fuel** (Agri-Residue Cooking Fuel) would readily facilitate having a cleaner cooking solution in Susan’s Bay community while efforts are made towards building the infrastructure needed for access to Modern Energy Cooking Services i.e., LPG and E-Cooking.



**ANNEXES****i. Survey Questionnaire Used During This Assessment**

SECTION A – Personal/Business Information of Respondents			
A-1	Date of Conducting Survey		
A-2	Language used for the conduct of this Survey	Krio <sup>24</sup>	
A-3	Household Address		
A-4	Telephone number		
A-5	Business Address		
A-6	Business Telephone number		
A-7	Type of Business	1	Local restaurant
		2	Tea   Coffee shop
		3	Local fast foods
A-8	Sex	1	Male
		2	Female
A-9	Respondent	1	Head
		2	Spouse
		3	Business Owner
		4	Business Assistant
		5	Other
A10	How many people live in your household		
A11	How many people do you cater for daily? [micro businesses/local restaurants/fast foods]	1	10-30 people
		2	40-80 people
		3	90 – 100+ people
Notes or Observations on Sections A, B, C, D, and E			
SECTION B – Means of Cooking and Energy Sources			

<sup>24</sup> To encourage maximum participation, Krio which is the widely spoken local language in Sierra Leone and particularly for inhabitants in Susan's Bay community. It will be used to conduct this survey

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B-1	Please tell me the primary means of cooking you use? Single answer.	1	Three Stone Cooking
		2	Metal charcoal stove
		3	Metal stove
		4	Kerosene stove
		5	Electric stove
		6	LPG Gas stove
		7	Improved Cook Stove
		9	Other (Specify)
		B-2	What fuel do you use for this means of cooking?
2	Charcoal		
3	Kerosene		
4	LPG		
5	Electricity		
6	Briquettes		
7	Pellets		
8	Other (Specify)		
B-3	What is your secondary cooking means? [If any]	Option(s) from B-1	
B-4	What fuel do you use for your secondary cooking?	Option(s) from B-2	
B-5	Why do you choose to use this fuel for your primary means of cooking? <sup>25</sup> Multiple answers or single answer are expected based on respondent.	1	It is <b>affordable</b>
		2	It is <b>accessible</b>
		3	It is a <b>clean fuel</b>
		4	I am used to it [ <b>cultural dynamics</b> ]
B-6	Why do you use this fuel for your secondary means of cooking? [If they have] Multiple answers or single answer are expected based on respondent.	1	It is <b>affordable</b>
		2	It is <b>accessible</b>
		3	It is a <b>clean fuel</b>
		4	I am used to it [ <b>cultural dynamics</b> ]
B-7	Do you do fuel stacking?	1	Yes
		2	No [Go to QB9.]
B-8	How many of cooking means you own?		
a.	What type(s) do you own?	1	Three Stone Cooking
		2	Metal Charcoal Stove
		3	Metal Firewood Stove
		4	Kerosene stove
		5	Electric stove
		6	LPG gas stove
		7	Improved Cook Stove
		8	Other
b.	What type of fuel or fuels do you use on this means of cooking? [Use fuel codes in B2]	1	Firewood
		2	Charcoal
		3	Kerosene

<sup>24</sup> Data collectors are advised/guided not to read out or prompt answers for survey respondents. [Optional answers on the left column of the questionnaire](#), serve as guide for the conduct of this survey.

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		4	LPG
		5	Electricity
		6	Briquettes
		7	Pellets
c.	Why do you choose this fuel for cooking? [Use preference code from B3]	1	It is <b>affordable</b>
		2	It is <b>accessible</b>
		3	It is a <b>clean fuel</b>
		4	I am used to it [cultural dynamics]
d.	How many types of these you use?		
B-9	Can I take a photo of your cooking option? <sup>26</sup>		
B10	Do you ever use more than one means of cooking AT THE SAME TIME?	1	Yes
		2	No
	Why do you use more than one means of cooking?		
<b>Assessment of LPG Users</b>			
B11	What LPG Cylinder do you use for cooking?	1	6kg
		2	12kg
B12	How many days does the 6kg LPG Cylinder usually last during the dry season?		
B13	How many days does the 12kg LPG Cylinder usually last during the dry season?		
B15	How many days does the 6kg LPG Cylinder last during the rainy season?		
B16	How many days does the 12kg LPG Cylinders last during the rainy season?		
B18	Where do you go to refill your LPG cylinder?	1	LPG Refuelling Plant
		2	Roadside Gas Vendors
		4	Home Delivery
		4	Fuel Station
B19	How many metres (how long/time) do you travel to exchange or re-fill your cylinders?		Respondent would indicate
B20	How many months have you had an LPG stove?	1	Less than 12 months
		2	More than 12 months
B21	If respondent say that she/he does not use LP G for cooking What is stopping you from using LPG for your cooking? Multiple answers or single answers are expected based on respondent	1	Not easily accessible
		2	Can't afford it
		3	Don't know about LGP
		4	Fear of explosion
		5	Other

<sup>24</sup> For evidence-based survey reporting, Data Collectors would seek the consent of respondents to take a photo of their cooking means and energy source



B22	Most people think that cooking with LPG is a sign of higher status	1	Agree
		2	Disagree
B23	Do you think that cooking with LPG is good for the wellbeing of your family?	1	Yes
		2	No
B24	It is generally acceptable in this community to cook with LPG [people are influenced by communal norms]	1	Agree
		2	Disagree
B25	What kind of payment scheme will you be willing to pay for LPG for cooking?	1	Full Payment
		2	Month End Payment
		3	Pay-As-You-Go
<b>Assessment of Biomass Users (mainly Firewood, and charcoal)</b>			
B26	Which type of kind of ICS do you use?	1	Artisanal clay lined
		2	Ceramic insulated
B27	Do you have easy access to biomass fuel for cooking purpose?	1	Yes
		2	No
B28	Where do you get your biomass fuel for cooking purpose?	1	Community vendor
		2	Another community
B29	How many metres (how long/time) do you travel to get biomass for cooking fuel?	1	Respondent
		2	would indicate
B30	How many months have you used your cookstove?	Respondent would indicate	
B31	What is stopping you from using Improved Cook Stove for your cooking? [If respondent says she/he does not use cookstove]	1	It is not accessible
		3	I can't afford it
		4	I don't know about ICS
		5	It is not very clean
		6	Other
B32	Cooking with improved cookstove is a sign of higher status. Indicate whether you agree or disagree with statement:	1	Agree
		2	Disagree
B33	Cooking with improved cook stove is good for your family Indicate whether you agree or disagree with the following statement:	1	Agree
		2	Disagree
B34	What kind of payment scheme will you be willing to pay for Improved Cook Stove?	1	Full Payment
		2	Month End Payment
		3	Pay-As-You-Go
<b>SECTION C – Health and Environmental Effects</b>			
C-1	Which of your MEANS of Cooking cause you/your family health problems?	1	Three Stone Fire
		2	Metal Charcoal Stove
		3	Metal Firewood Stove
		4	Kerosene Stove
		5	Electric Stove
		6	LPG Stove
		7	Improved Cook Stove
		8	Other

C-2	Which Cooking Energy Fuel use that cause you/your family problems?	1	Firewood
		2	Charcoal
		3	Kerosene
		4	Electricity
		5	LPG
		6	Briquette
		7	Pellets
C-3	What problem(s) does that means of cooking cause? [Multiple answers] Do not read list to respondent	1	Makes us cough
		2	Makes eyes sting
		3	Dirty homes
		4	Burns
		5	Can cause a house fire
		6	Causes headaches
		7	Explosions
		8	Increased heat level
C-4	Have you had to seek medical attention as a result of the means of cooking you are using?	1	Yes
		2	No
C-5	Do you think the fuel you use for cooking affects the environment?	1	Yes
		2	No
C-6	Do you believe that using cleaner means of cooking like LPG or ICS can improve the effects on the environment and our health?	1	Yes
		2	No
<b>SECTION D – Social and Cultural Implications</b>			
D-1	Why do you not use your LPG stove more frequently? Multiple answers or single answer are expected based on respondent.	1	The gas is expensive
		2	Refilling distance
		3	Some food are cooked using other means
D-2	Why do you not use your Improved Cook Stove more often? Multiple answers or single answer are expected based on respondent.	1	The fuel is expensive
		2	Certain food can't be cooked on stove
		3	Distance for fuel
		4	Safety Concern
D-3	What benefits will your improved cooking option means have for you and your family? Multiple answers or single answer are expected based on respondent.	1	Cook faster
		2	Less fuel use
		3	Modernize our kitchen
		4	Kitchen will be cleaner
		5	Improved our health
		6	Other
D-4	Before our visit, had you heard about Improved Cook Stove for cooking?	1	Yes
		2	No
D-5	Before our visit had you heard about LPG for cooking?	1	Yes
		2	No
D-6	Why did you buy an Improved Cook Stove or L P G for cooking? [If respondent had bought]	1	To replace an old one
		4	To cook inside house
		5	Want to cook faster
		6	Want to cook using clean energy
		7	Other

## SECTION E – Business Model and Financial Implication on Cooking Energy Options

E-1	How do you pay for your cooking Energy Fuel?	1	Cash (One Payment)
		2	Cash (Instalment)
		3	Mobile Money
		4	Workplace scheme
		5	Pay As I Go
E-2	How much do you spend weekly on Charcoal during the Dry Season to cook?		
E-3	How much do you spend weekly on Charcoal during the Rainy Season to cook?		
E-4	How much do you spend weekly on Firewood during the Dry Season to cook?		
E-5	How much do you spend weekly on Firewood during the Rainy Season to cook?		
E-6	How much do you spend weekly on Kerosene during the Dry Season to cook?		
E-7	How much do you spend weekly on Kerosene during the Rainy Season to cook?		
E-8	How much does it cost to exchange a 6kg LPG Refilled Cylinder?		
E-9	How many times do you exchange a refill 6kg LPG Cylinder?		
E10	How much does it cost to exchange a 12kg LPG Refilled Cylinder?		
E11	How many times do you exchange a refill 12kg LPG Cylinder?		
E12	Has your choice of cooking fuel increased the amount of money you spend on cooking?	1	It has increased
		2	It has decreased
E13	How important is affordability of the means of cooking to your family	1	Important
		2	Not important
<b>For Biomass (Charcoal/ Firewood) Transporters, Vendors and Unlined-Metal Stove Producers <i>if encountered</i></b>			
E14	Do you think that the using improved means of cooking that are accessible, affordable and cleaner will affect your means of livelihood?	1	Yes
		2	No
E15	What condition(s) you think need to be in place to help with implementing clean cooking solution in your community?	Recommendation(s) from respondents	

## ii. Contact of Key Stakeholders

Below is a compilation of key project and national stakeholders ILEM-Africa met during the conduct of this Feasibility Assessment.

Stakeholder	Institution	Name	Job Title	Contact
Project Partners	ICLEI – Africa	Carine Buma	Project Manager	<a href="mailto:carine.buma@iclei.org">carine.buma@iclei.org</a>
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		Kweku Koranteng	Country Lead-Uganda	<a href="mailto:kweku.koranteng@iclei.org">kweku.koranteng@iclei.org</a>
	Energy 4 Impact	Mercy Rose	Project Manager	<a href="mailto:mercy.rose@energy4impact.org">mercy.rose@energy4impact.org</a>
		Kevin Wafula	Project Officer	<a href="mailto:kevin.wafula@energy4impact.org">kevin.wafula@energy4impact.org</a>
	Freetown City Council	Yvonne Aki-Sawyer	Major of Freetown	<a href="mailto:yvonne.aki.sawyerr@fcc.gov.sl">yvonne.aki.sawyerr@fcc.gov.sl</a>
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	Susan's Bay Council	Medinatu Kamara	Councilor	
	FEDURP	Yirah Conteh	Coordinator	<a href="mailto:oryanks2@gmail.com">oryanks2@gmail.com</a>
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	GUMA Water Company	Maada Kpenge	Managing Director	<a href="mailto:mkpenge@gumavelley.sl">mkpenge@gumavelley.sl</a>
Francis Lahai		Dpt. Managing Director	<a href="mailto:francis.lahai@gmail.com">francis.lahai@gmail.com</a>	



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