Republic of Liberia

Liberia National Methane Roadmap and Action Plan (M-RAP)

Environmental Protection Agency
Republic of Liberia
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Foreword

I am pleased to announce the completion of Liberia's National Methane Roadmap and Action Plan (M-RAP). This M-RAP represents a significant step in Liberia's commitment to address methane emission, which is a major contributor to rising greenhouse gas concentrations and is thought to contribute up to one-third of short-term global warming.

While Liberia's methane emissions are relatively low compared to other countries, we recognize that key emitting sectors such as agriculture, waste, energy, and transportation are growing. This roadmap demonstrates our proactive approach to keeping emissions in check at their sources while enforcing existing policies, creating new policies where necessary, improving reporting, and modifying practices that emit methane.

The M-RAP aligns with Liberia's broader climate commitments, including our ambitious Nationally Determined Contribution (NDC) targets and the Global Methane Pledge. Through this roadmap, we commit to implementing measures that will deliver multiple benefits - improving human health, enhancing food security, protecting ecosystems, and contributing to many Sustainable Development Goals.

I want to thank the expert support of Greenlife West Africa for developing this roadmap and the Climate and Clean Air Coalition (CCAC) for funding this initiative. This achievement would not have been possible without the collaborative efforts of the CCAC Focal Point, the CCAC National Coordinator for Liberia, and all key stakeholders who contributed their expertise and insights. Your unwavering commitment has ensured Liberia is better positioned to mitigate methane emissions and promote cleaner air and healthier communities.

Successfully implementing this roadmap will require financial support and the involvement of actors from all sectors and levels of society. Let this roadmap remind all of us to integrate methane reduction strategies into our national policies as we commit to building capacity for emissions accounting and developing the necessary frameworks to keep emissions in check while supporting sustainable development. Let us continue working with our development partners to implement the M-RAP.

Dr. Emmanuel Urey Yarkpawolo
Executive Director/CEO
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Executive Summary

Liberia's National Methane Roadmap and Action Plan (M-RAP) represents a significant commitment to address methane emissions as part of the country's broader climate action strategy under the CCAC-UNEP. While Liberia's methane emissions are relatively low compared to other countries, contributing approximately 0.4 MtCO2e according to recent assessments, the country recognizes the critical importance of taking proactive measures to control emissions from growing sectors such as agriculture, waste, energy, and transportation.

The M-RAP was developed through robust stakeholder engagement processes, employing a whole-of-government approach. Key stakeholders included relevant sectoral line ministries and agencies, private sector entities, civil society organizations, and national experts. This inclusive process ensures broad ownership and effective implementation of the roadmap.

The roadmap outlines specific interventions across key sectors. In agriculture, focus areas include improving rice cultivation methods, reducing field residue burning, and implementing improved livestock management practices. For waste management, emphasis is placed on developing comprehensive strategies including the promotion of waste separation at the household level, and building environmentally sustainable landfills and methane recovery systems. The energy sector commits to universal access to affordable, sustainable, and environmentally friendly low carbon energy services, while the transportation sector focuses on increasing the availability and use of Electric Vehicles (EVs) and enforcing laws that discourage the importation and use of motor vehicles older than ten years.

Implementation of the M-RAP requires multi-stakeholder involvement and capacity building across all sectors. Key elements include development of robust emissions accounting and reporting systems, enhancement of institutional frameworks for methane management, strengthening of technical capacity for emissions monitoring and reduction, and integration with existing climate change policies and strategies. The roadmap also emphasizes the importance of improving data collection and reporting mechanisms to ensure transparent compliance with international commitments.

The availability of data from the methane emitting sectors was a challenge. Hence, data generation and sharing will play a major role in the successful implementation of the M-RAP, which includes a robust M&E plan that requires a midterm review after 3 years based on the availability of data.

The successful implementation of this roadmap will position Liberia as a leader in climate action among developing nations, while supporting sustainable development and improving the quality of life for its citizens. This commitment demonstrates Liberia's dedication to global climate action, despite its status as a low-emissions country.

Acronyms and Abbreviations

CCAC	Climate and Clean Air Coalition
CH4	Methane
CO2	Carbon dioxide
EPA	Environmental Protection Agency
EV	Electric Vehicle
Gg	Gigagrams
GMP	Global Methane Pledge
IPCC	International Panel on Climate Change
LEC	Liberia Electricity Corporation
LPRC	Liberia Petroleum Refinery Company
LRA	Liberia Revenue Authority
LULUCF	Land Use, Land Use Change, and Forestry
LWSC	Liberia Water and Sewer Corporation
PCC	Paynesville City Corporation
MCC	Monrovia City Corporation
MFDP	Ministry of Finance and Development Planning
MIA	Ministry of Internal Affairs
MME	Ministry of Mines and Energy
MOC	Ministry of Commerce
MOH	Ministry of Health
MOT	Ministry of Transport
MPW	Ministry of Public Works
M-RAP	Methane Roadmap and Action Plan
Mt	Megatons
NADP	National Agriculture Development Policy
NAP	National Adaptation Plan
NAPA	National Adaptation Program of Action
NDC	Nationally Determined Contribution
NEP	National Environmental Policy
NPRSCC	National Policy and Response Strategy on Climate Change
NPA	National Port Authority
NTA	National Transit Authority
RREA	Rural Renewable Energy Agency
SDG	Sustainable Development Goal
SWM	Solid Waste Management
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change

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1.0 Background

1.1 Importance of methane mitigation

Methane emission is a major contributor to the rising concentration of greenhouse gases in the Earth's atmosphere, and are thought to contribute up to one-third of short-term global warming. Methane emission has been rising in Liberia, peaking to 0.4 million MtCO2e in 2015. World Economics Country Reviews[1] in 2019 confirms Liberia's methane emissions to be the same amount and suggests that this places Liberia as the 149th worst methane emitter globally. Although methane emission is low compared to other countries, there are concerns that the key methane emitting sectors such as the agriculture, waste, energy and transportation are growing; and in the absence of adequate activity data from these sectors, the figures could be under-reported. Based on recent sectoral activities resulting from developments in all of these sectors, we believe that recent data, when available, would verify the rising profile of methane emission in Liberia.

Liberia needs to improve on methane data harvesting from sources and reporting, so as to transparently meet Article 12, paragraph 1(a) of the United Nations Framework Convention on Climate Change (UNFCCC) on communication of information related to implementation. This requirement not only applies to the National Communications and Nationally Determined Contributions (NDCs), but also reporting under the Methane Roadmap and Action Plan (M-RAP).

Mitigation measures to halt emissions however low the emission may be should be supported, due to the potential of emitting sectors to increase with population growth, socio-economic, and technological advancement. Hence, it is importantly to implement measures to improve reporting, while keeping emissions in check at source, and modifying processes that emit methane or increase efforts at methane recovery. Liberia's methane emission sources include agriculture, oil and gas, transport and Municipal Solid Waste (MSW) and wastewater such as household sewage and industrial effluent. The involvement of actors from all levels of these sectors in the M-RAP is cardinal. All activities to keep methane emissions low must begin with the participation of the right stakeholders whose capacity would be built to account for emissions and emissions sources, and commit to keeping emissions in check.

1.2 Link between methane mitigation, reduction of tropospheric ozone and associated benefits to public health, agriculture and other SDGs

Global action to reduce methane emissions has benefits for human health, food security, and ecosystems, as it can curb the formation of tropospheric ozone, an air pollutant with multiple harmful impacts on human health. Beyond undermining public health, methane (and co-emitted pollutants) impacts health by contributing to ground-level ozone and particulate pollution that causes and exacerbates respiratory and cardiovascular diseases, cancer and stroke. Methane, in the harsh sunlight of the upper atmosphere can react with other gases to form water vapor, which then breaks down into other chemicals that destroy ozone. Methane's potent climate warming effect means even small amounts have an outsized impact on climate, environmental, and human health. Not only does methane have a warming effect, it also acts as a precursor for the toxic air pollutant

[1] https://www.worldeconomics.com/country-reviews/liberia/

tropospheric ozone. However, methane as a precursor to tropospheric ozone means that reducing it produces major air pollution benefits which, because ozone stunts plant growth, can not only increase agricultural production but also prevent 260,000 premature deaths annually from air pollution by 2045. The goal of the Global Methane Pledge (GMP), which Liberia has acceded to is to work with member countries to exploit these multiple benefits which include meeting many SDG targets (e.g goals 2, 3, 6, 7, 11 and 12) through programs like the M-RAP.

1.3 Other multiple benefits of methane reduction

Reducing methane at planning and activity levels have multitude of benefits including cost savings on mitigation efforts as well as benefits for humans, ecosystems, and species. Reducing human-caused methane emissions is one of the fastest, most cost-effective strategies to reduce the rate of warming and contribute to global efforts to limit temperature rise to 1.5°C[2]. Methane reduction also provides a great environmental benefit, producing more heat and light energy by mass than other hydrocarbons, or fossil fuels, including coal and gasoline refined from oil, while producing significantly less carbon dioxide and other pollutants that contribute to smog and unhealthy air.

Reducing methane including from the growing fossil fuel industry offers multiple benefits such as improving human and ecosystem health; slowing the rate of warming, which can help prevent dangerous climate tipping points; improving air quality that can save hundreds of thousands of lives, especially in poor countries suffering from black carbon pollution from firewood and biochar use; improving food security by preventing crop losses; and creating jobs through mitigation efforts while increasing productivity through reduced heat stress. According to the Climate and Clean Air Coalition (CCAC), every year, these benefits would be equal to a global saving of approximately US$470 billion[3]. Liberia with huge dependence on fossil fuel and biomass like fuelwood and biochar has a growing problem with black carbon at the household and community levels. Methane reduction would reduce indoor air pollution and a big part of that in the Liberian context is to improve energy efficiency through use of improved cook stoves and kilns.

1.4 Methane Roadmap Project Objectives

The methane roadmap project's objectives are to:

- Develop Liberia's National Methane Roadmap, and have it validated by the Government of Liberia;
- Integrated the roadmap into the national process through the training of national experts and the private sector; and
- Raise awareness to increase knowledge on new technologies, and change attitudes and behavior around climate smart agriculture, waste management, and low emissions development activities.

The expected outcomes of the project are:

- Methane roadmap developed and validated by the government of Liberia
- Capacities of stakeholders and national experts strengthened to implement the methane roadmap

[2] https://www.ccacoalition.org/content/benefits-and-costs-mitigating-methane-emissions#:
[3] https://www.ccacoalition.org/content/benefits-and-costs-mitigating-methane-emissions

2.0 National Context and Policies

One of the first efforts to address climate change by the Environmental Protection Agency (EPA) of Liberia after rectifying the United Nations Framework Convention on Climate Change (UNFCCC) in 2002 was the 2008 submission of its National Adaptation Program of Action (NAPA) recognizing the crippling effects of climate change on the post-war, Least Developing Country's (LDC) economic sectors. The NAPA was followed in 2013 by the submission of the report - Identification of Capacity Barriers, Gaps and Needs for Enabling Climate Change Mitigation Measures. These two early reports signified Liberia's intention to address climate change along the two tracks of adaptation and mitigation. Since then, there have been many studies, reports, analyses, and briefs produced. There have been several agreements, protocols and conventions that Liberia has acceded to in furtherance of the commitment to the fight against climate change. Liberia's 2021 signing of the Global Methane Pledge (GMP) to reduce methane emissions by 30% below 2020 levels by 2030 and submission of a Nationally Determined Contribution (NDC) to the UNFCCC are huge steps in that direction. However, the GMP is yet to be fully domesticated, that is, elaborated into sectoral policies and regulations in a way that actualize the fulfillment of the GMP. Capacity issues bordering on data gaps has to be resolved to further the objectives of the GMP.

The absence of data is a limiting factor for reporting and is often cited as the reason for non-compliance to international pledges and commitments. According to the Climate Change Data Gap Analysis Report, another challenge is that in areas where data exists, public access is restricted to some extent. Hence, there is limited capacity to monitor, forecast, archive, analyze, and communicate climate change information. Data related to climate change cuts across multiple sectors. Liberia should have a functional platform to make climate data and related information accessible across all sectors. The agreements for data management and sharing being signed between the EPA and various line ministries and agencies coupled with targeted trainings would help to breach the data gap. Notwithstanding, the data gaps in the methane emitting sectors, however, below are enabling policies and regulations that could guarantee that climate data management protocols would succeed to ensure that sector activities contribute to GMP and the NDC targets.

International Commitments

1. Liberia's Initial National Communication - **2013** (Liberia. National Communication (NC). NC 1. | UNFCCC)
2. Liberia's First Biennial Update Report - **OCTOBER 2020** (Liberia. Biennial update report (BUR). BUR 1. - Climate Change Laws of the World (climate-laws.org))
3. Liberia's Second National Communication - **APRIL 2021** (Liberia. National communication (NC). NC 2. | UNFCCC)
4. Liberia's Revised NDC - **JULY 2021** (Liberia | Nationally Determined Contribution (NDC) | Climate Watch (climatewatchdata.org))
5. Global Methane Pledge **2021**: https://www.ccacoalition.org/resources/global-methane-pledge

2.1 Cross-cutting Policy

2.1.1 The National Policy and Response Strategy on Climate Change (NPRSCC)

On Agriculture: move towards a sustainable agricultural system by encouraging lowland farming, investing in smallholder agriculture, and allowing large-scale concessions on degraded land to avoid and reduce national emissions levels.

On Waste: Pursue the development and implementation of a comprehensive waste management strategy that includes the development of environmentally sustainable landfills, recovery and use of methane emissions for energy generation and instituting programs at the community and national level for recycling, reducing, and reusing waste.

On Energy: Improve Liberia's economy and social sectors toward universal access to affordable, sustainable, and environmentally friendly low carbon energy services.

On Transportation: Build the future of Liberia's transport system and associated infrastructure on a low carbon emitting basis.

On Mining: Ensure that the mining sector in Liberia develops in an environmentally sustainable manner by gradually mixing the use of low emission energy sources and technologies. This sector's mitigation strategy includes measures such as "Explore and promote best practices for methane recovery."

2.2 Waste Sector

2.2.1 The National Solid Waste Management Policy

This overarching waste management policy outlines the vision of the Government of Liberia, which recognizes that effective and efficient waste management is essential to the development of sound public health and improved quality of life. Waste management should be implemented in a gender sensitive, environmentally and socially equitable manner using the most economical means available. The National Solid Waste Management Policy provides a broad framework for the implementation of national objectives and builds synergies with existing policies and legal instruments governing waste management issues in Liberia.

2.2.2 The Assessment of Solid Waste Management (SWM) in Liberia (UNEP, 2007)

A widespread percent of the waste generated in Monrovia is natural refuse accompanied by plastic. The growing amount of plastic waste is a result of the multiplied use of plastic merchandise available in the marketplace in Monrovia e.g. plastic sachet water, polyethylene terephthalate (PET) bottles, and plastic luggage generated. A study by Tokpah et al (2022) on the composition of solid waste generated in Monrovia found that about 40% of wastes are organic refuse and vegetables. Together with paper wastes which are also biodegradable, they make up more than 50% of waste by volume. This indicates the amount of methane emitting effluent that waste can potentially generate in landfills and dumpsites.

2.2.3 Environmental Protection and Management Law of the Republic of Liberia, 2002

Section 39 Solid Waste Management Standards – within 12 months of the effective date of this Law, the Agency, in cooperation with relevant ministries, agencies, city and county governments, and in consultation with other stakeholders in communities, and after public hearings, developed

and published national guidelines for solid waste management; the guidelines shall include strategies and incentives for reducing, recycling, and reusing waste.

Section 64 of the Act speaks to application for a Solid and Hazardous Waste Disposal License. The Agency shall establish guidelines for the operation of solid waste and hazardous waste facilities.

Section 68 commits the Agency to maintain a registrar of all garbage, waste licenses and any other pollution license issued pursuant to this Law.

2.2.4 Assessment of the National Environmental Policy (NEP) of the Republic of Liberia, 2002 - focus on the Waste Sector

A careful review of the NEP shows that its policy actions and recommendations are majorly captured in the waste targets (mitigation and adaptation) outlined in Liberia's Nationally Determined Contributions (NDC). However, the study establishes the lack of a national waste policy, which underpins the myriad of challenges that riddle the sector.

The enactment of the NEP in 2002 came at a time when Liberia's infrastructure was seriously destroyed during the civil conflict which significantly undermined the delivery of sanitation services. The public solid waste system collapsed in both urban and rural areas. Indiscriminate open disposal of waste was the most common disposal method in municipalities and local areas across the country, in particular, the capital city of Monrovia which hosted the bulk of Liberia's urban population.

Even though some significant achievements have been made in the sector especially in Monrovia, waste management remains a challenge throughout the country. Other cities and towns across the country are also experiencing rapid population growth with the associated potential for increased waste generation in the absence of an organized waste management program. The establishment of a few waste collection centers in Monrovia and a centralized disposal site in Whein Town may be hailed as success stories (although the Whein Town Landfill has since reached its maximum capacity). Of concern also is the backlog of garbage at the collection centers, which speaks to the logistics and technical challenges affecting the sector.

2.2.5 Institutional Framework for Waste Management in Liberia

The following institutions have legal mandates over solid waste management in the country in accordance with the NEP:

- ✓ Ministry of Internal Affairs (MIA): the lead authority when it comes to solid waste management, mobilizes and ensures participation of municipal and local entities in the sector;
- ✓ Municipal and Local Government Entities: Municipal and local government agencies are involved in street sweeping, collection and disposal of solid waste and beautification, among other waste and sanitation activities;
- ✓ Monrovia City Corporation (MCC): The Solid Waste Management Department of the MCC takes lead in ensuring sustainable management of solid waste in the city of Monrovia. It promotes and safeguards public health through street cleaning; waste collection, transfer, processing of garbage; promotion of waste reduction, reuse and recycling of solid waste, safe composting, and disposal of solid waste and other substances that cause environmental

nuisances and health hazards. The Department is guided by and acts under the power vested by:

- City Ordinance No. 1 (Section 2(b), 4); 7 and 9.
- Provisions within the Public Health & Safety Law.
- Solid Waste Management Plan of MCC.

- ✓ Paynesville City Corporation (PCC): Municipal Solid Waste Management (MSWM) refers to the organized handling, collection, transportation, treatment, and disposal of waste generated in urban areas. It is a critical function of PCC to ensure a clean, healthy, and sustainable environment for its residents. This involves a combination of technical, financial, and community-driven approaches to minimize the environmental and health impacts of waste.
- ✓ Environmental Protection Agency (EPA): The EPA has oversight on environmental issues. It coordinates, monitors, supervises, and consults with relevant stakeholders on all activities in the protection of the environment and sustainable use of natural resources;
- ✓ Ministry of Health (MOH): The MOH is mandated to conduct sanitation inspection and to ensure compliance with public health laws, articles, and guidelines. Preventive health, occupational health, and health waste management are among its key mandates.
- ✓ Ministry of Mines and Energy (MME): The MME provides guidance for geotechnical investigations of engineered landfill sites, oversees the development and management of natural resources, particularly the water resources central to the Water Sanitation and Hygiene (WASH) sector, and to conduct scientific and technical investigations required for environmental assessments;
- ✓ Ministry of Public Works (MPW): The MPW has mandate over the development and construction of solid waste management infrastructure such as transfer stations and engineered landfill disposal sites;
- ✓ WASH Commission: The WASH Commission was established to increase safe water coverage, improve access to sanitation, and improve hygiene by coordinating efforts and implementing comprehensive programs with other relevant government institutions.
- ✓ Liberia Water and Sewer Corporation (LWSC): The LWSC was created by an Act to amend the Public Utilities Law in 1973. The Corporation is empowered to perform all sewerage services, as well as to maintain such water and sewerage facilities in Liberia.
- ✓ The private sector basically comprises Community Based Enterprises (CBEs) involved in primary waste collection; and Small Medium Enterprises (SMEs) who transport waste from designated collection sites to the only land fill site in Whein Town. A few of these private companies are involved in composting, waste material recycling, and reuse into biofuel and other alternative forms of energy.

2.2.6 The Ministry of Health and Social Welfare (MHSW)

The Public Health Law contains provisions, governing public nuisance, adulterated foods, sewage systems, occupational health and chemical safety, and protections for drinking water supply sources and streams, among other things. The Law prohibits the disposal of sewage, industrial or agricultural waste, or any other materials injurious to the public health into waters of the Republic,

unless express written permission has been granted by the Minister (Public Health Law). Apparently, there has been little enforcement under these provisions. (Liberian Biodiversity Country Study)[4].

2.3 The Agriculture Sector

2.3.1 Ministry of Agriculture

The Ministry of Agriculture (MoA) administers the Agriculture Act of 1973, as amended, and works to protect plants and animals in Liberia from the introduction of pests and diseases. The Ministry is also involved with the regulation of the forestry and agriculture sectors, including fisheries, plantations, and animal husbandry. The Agriculture Act of 1973 specifically prohibits the removal of palm trees in Liberia and authorizes the Ministry to promulgate rules for the "protection of marine life in rivers and streams and the protection of water pollution within the Republic[5]."

2.3.2 Rice Farming Context in Liberia

The supply, demand, and price dynamics of rice are shaping food insecurity and poverty in Liberia. Rice makes up over 20% of total food consumption, accounts for nearly half of the calorie intake of adults, and accounts for about 15% of the overall spending of an average household in the country. Demographic trends and a strong preference for the commodity are the main drivers of demand. Yet Liberia produces only a third of its rice needs due to several constraints, including limited access to technology, inefficient farming practices, low public and private investments, and a fragmented value chain, among other factors that have kept productivity low[6].

The World Bank Fourth Edition of its annual Liberia Economic Update, "Getting Rice Right for Productivity and Poverty Alleviation," states that growth in the agricultural sector accelerated to 5.9% in 2022 from 3.3% in 2021. Increased crop production, especially rice and cassava produced primarily for domestic consumption, was the main driver of growth in the agriculture sector.

Most of the rice farmers in Liberia operate at subsistence level cultivating small plots of rice farms ranging from 0.5 to 1.0 hectare, in the low land. Few of the issues with rice production identified during the survey by the Smallholder Agricultural Productivity Enhancement and Commercialization (SAPEC) Project[7] are presented below:

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[4] https://www.eli.org/sites/default/files/eli-pubs/d19-16.pdf

[5] https://www.eli.org/sites/default/files/eli-pubs/d19-16.pdf

[6] https://www.worldbank.org/en/news/press-release/2023/07/18/liberia-economic-update-improved-rice-production-is-critical-for-food-security-and-poverty-alleviation
https://www.moa.gov.lr/sites/default/files/documents/BASELINE%20SURVEY%20IN%20THE%20RICE%20SECTOR%20DEVELOPMENT%20HUBS%20I

[7] https://www.moa.gov.lr/sites/default/files/documents/BASELINE%20SURVEY%20IN%20THE%20RICE%20SECTOR%20DEVELOPMENT%20HUBS%20I

1. Use of improved technologies in rice production is very low among the interviewed farmers due to inadequate access to available modern techniques of rice production and processing;
2. Most of the farmers cultivate rice under rain-fed upland ecosystem as most of the lowland areas have not been developed to facilitate its use for rice production;
3. Use of improved high yielding rice varieties is very low as majority of the farmers plant the local varieties;
4. Seeds from the previous season form the major source of the planting material (seeds) for the farmers;
5. Farmers have not been exposed to Community Based Seed System (CBSS) that can serve as a reliable and best alternative source of seeds procurement;
6. Only imported rice are available in the market for general consumption of the public all year-round;
7. The majority of the farmers have limited access to extension services. Hence, no significant interaction between the extension technicians of MoA, NGOs, and the farmers that could lead to self-sufficient practices in rice production;
8. Almost all the rice farmers do not own or have access to mechanization tools such as power tiller, planters, weeding machine, and processing equipment that can facilitate mechanization of rice production.

2.3.3 National Agriculture Development Plan 2024-2030

The National Agriculture Development Plan (NADP) 2024-2030 is intended to revitalize Liberia's agricultural sector, put it at the forefront of the country's economy, and enhance Liberia's self-sufficiency in food production. In the face of global climate change and economic crises, ensuring food security is paramount. The NADP is designed to be a game changer, leveraging inventive strategies, modern technologies, and comprehensive investments to build a more secure and sustainable future. This initiative is designed to support and empower farmers to increase productivity and efficiency through strategic investments in agricultural infrastructure, technology, and research.

2.3.4 National Rice Development Strategy II 2018-2030

The strategy aims to attract investment by creating the enabling environment for business development, and improving access to finance for rice farmers and processors. There is a need to improve local research on rice seed varieties as well as soil health and fertility. The strategy also includes eradicating the high incidence of pests and diseases; and improve the policy, institutional and coordination framework for the rice sector. It requires awareness and an active private sector.

2.3.5 Roadmap for Rangelands Restoration

This report offers a technical overview of the rangelands under the government of Liberia's

administration in seven counties. It includes details such as their locations, sizes in hectares (Ha), stocking capacities, and current operational statuses. This information is crucial for gaining insight into the potential and limitations of each rangeland for livestock farming in Liberia.

2.3.6 Food and Agriculture Policy and Strategy (FAPS)

The FAPS goal is to build "a revitalized and modernized agriculture sector that is contributing to the shared, inclusive, sustainable economic growth, and development of Liberia." Its guiding principles are macroeconomic stability, pluralism and clarity of roles; enhanced private sector involvement and competition; self-reliance; maximization of comparative advantage; value addition; sustainable development management and decentralization.

2.4 The Energy Sector

2.4.1 Ministry of Mines and Energy (MME)

The MME functions in the area of policy formulation for the energy, hydrocarbon and water sectors of Liberia. The Ministry performs the following among other functions:

- ✓ Promote research programs and activities favoring the development of new and alternative renewable sources of energy;
- ✓ Monitor and enforce compliance of all policies, laws, and regulations pertaining to research, exploration, development and exploitation of mineral, waters and energy resources in Liberia;
- ✓ Promulgate new regulations to guide and govern the mineral and energy sectors;
- ✓ The MME heads the Policy Council of the EPA. The National Environment Policy Council ("Policy Council") of the EPA is the decision-making body for policy formulation and direction of the Agency on issues of environmental protection and to address climate change.
- ✓ The Policy Council is a potential conduit for methane mitigation mainstreaming at the highest level of the government. Their understanding of the value and contribution of methane to sustainable low emissions development is much more advanced and their power and influence are far reaching to affect change.
- ✓ The MME is also part of the Board of Directors of the Liberia Electricity Corporation (LEC), the National Oil Company of Liberia (NOCAL) and Rural and Renewable Energy Agency (RREA).
- ✓ All energy data should be submitted to the MME. However, MME is facing serious challenges with receiving data from other government institutions.
- ✓ The MME is collaborating with the Ministry of Transport. Together, they are regarded as the biggest sources of Greenhouse Gas emissions in Liberia next to the AFOLU sector. They are also the sectors least regulated for emissions reduction because of limited enforcement of policies and strategies to guide sector activities towards low emissions activities. There are challenges including low staff and logistics.

2.4.2 National Energy Policy of Liberia (NEPL), 2009

The NEPL aims to reduce reliance on traditional fuel and increase the use of modern and renewable energy sources. The NEPL (2009) was developed with a set of goals targeted at maximizing efficiency, minimizing costs and adverse environmental impacts as principle in extending energy access to all Liberians. Liberia's Initial National Communication submitted to the UNFCCC reinforces the NEPL with additional long-term targets and related activities, which include:

- ✓ Reducing GHGs by at least 10% by 2030
- ✓ Improving energy efficiency by at least 20% by 2030
- ✓ Raising share of renewable energy to at least 30% of electricity production and 10% of overall energy consumption by 2030
- ✓ Replacing cooking stoves with low thermal efficiency (5-10%) with the higher efficiency (40%) stoves.

2.4.3 Electricity Law of Liberia, 2015

The Electricity Law states its purpose and scope as the establishment of the legal and regulatory framework for the generation, transmission, distribution, and sale of electricity within the territory of the Republic of Liberia, and the import and export of electricity and to facilitate the implementation of the National Energy Policy of Liberia. In defining the legal boundaries under which electricity is to be generated, transmitted and distributed within Liberia, everything to do with this resource is done within the scope of the Electricity Law. This presents an opportunity to effect reforms through the provisions of this Law.

2.4.4 Liberia Electricity Regulatory Commission Act, (LERC), 2015

The LERC was established as the autonomous electricity industry regulator under the Electricity Law of Liberia. The LERC diverges all other energy sector players of this important role, thereby bringing some clarity to the sector. However, being a new institution, the LERC needs to be empowered to enforce regulations that are related to climate actions through advocacy and capacity strengthening. The LERC can become an important partner in enforcing any aspects of climate change mitigation actions through regulations.

2.4.5 Rural and Renewable Energy Agency (RREA) Act, 2015

The RREA and the Rural and Renewable Energy Fund (RREFUND), were together enacted into law in 2015. The RREA is independent and autonomous and its mandate includes:

- ✓ Integrating energy into rural development planning; promotion of renewable energy technologies; facilitating delivery of energy products and services through rural energy service companies (RESCOs) and community initiatives;
- ✓ Facilitate and accelerate the economic transformation of rural Liberia by promoting the commercial development and supply of modern energy services to rural areas with an emphasis on locally available renewable resources;

- ✓ Planning and financing of rural energy projects for implementation by public, private and community developers. This includes educating the general public about renewable energy options and opportunities;
- ✓ Manage the Rural Energy Fund (REFUND), a transparent financial management system through which all domestic and international resources intended for rural energy programs shall be managed in order to help achieve universal energy access in Liberia.
- ✓ The RREA remains one of the best institutions to promote the wide spread use of renewable and clean energy solutions to often marginalized and off-grid communities. As a partner in NDC target delivery in the sector, this entity's contribution is huge in terms of fulfilling its mandates and programs. Capacity building to capture data on avoided emissions from clean energy should be prioritized as RREA expands rural and renewable electrification and energy supply around the country.
- ✓ As of November 2024, RREA has five renewable energy (hydro and solar) projects providing mini-grids in rural areas leading to the avoidance of 1.4 tons of Greenhouse Gases. RREA was instrumental in the creation of Executive order 134 signed by the President, which reduces tariffs on solar products. Based on article 134, RREA provides due diligence for the importation of solar vehicles or products. RREA serves areas that are not captured by the main grid. RREA has also developed the Rural and Renewable Energy Masterplan.

2.4.6 National Energy Efficiency Action Plan (NEEAP), 2016

The NEEAP is rooted in the ECOWAS Energy Efficiency Policy (EEEP) which includes targets, measures, standards and incentives for energy efficiency (EE) to be implemented at both regional and national levels. The main objectives to be achieved with the NEEAP are:

- ✓ To implement efficiency measures that free-up 1,054 MW of power generation capacity by 2030. At an average of 53 MW per year;
- ✓ Phase out inefficient incandescent lamps by 2018;
- ✓ Reduce average losses in electricity distribution from the current levels of 28-40% to the world level of 10% by 2024.

Energy efficiency has been regarded by many energy experts as a low hanging fruit when it comes to mitigation activities in the sector considering the megawatts of energy EE policies free up and the reduction in energy losses to globally acceptable levels.

2.4.7 Oil and Gas Industry

Liberia does not have a well-developed upstream oil and gas industry. Hydrocarbon exploration activities in Liberian territorial waters started in the late 1960s, but those activities ceased due to a variety of factors.

The National Oil Company of Liberia (NOCAL) oversees petroleum exploration, development, and production, and the Liberia Petroleum Regulatory Authority (LPRA), manages regulation and policy.

Liberia does not have a functioning refinery. All petroleum products are imported from abroad. According to the Central Bank, imported petroleum products – fuel, minerals, and lubricants – amounted to $161 million in 2020, representing 16 percent of total import payments.

The Liberia Petroleum Refining Company (LPRC) is a state-owned enterprise responsible for issuing petroleum importation licenses and storing petroleum products imported into the country by private businesses. The LPRC owns storage tanks at its Product Storage Terminal (PST) near the Freeport of Monrovia where it stores imported petroleum products on behalf of local importers who sell or distribute petroleum on a wholesale basis. A few Liberian-owned petroleum companies, including Srimex Oil & Gas, Conex Group, and Aminata & Sons who are also importers and/or distributors have their own storage facilities located in the compound of the LPRC.

Most filling stations are owned by Liberians, some of whom are in partnership with Lebanese-owned fuel importers and distributors. With no oil production activities, Liberia's methane emissions from oil and gas can be estimated from scope 1 sources and the rest of the energy sector from scope 1 and 2 sources.

According to the Aether report - Liberia National GHG Inventory Sectoral Report, emissions of CO2, CH4 and N2O will occur with combustion of fuels in all sectors (for example in electricity production, households and transport) as well as fugitive emissions arising from oil and gas production (which is not occurring in Liberia).

LPRC doesn't have an emissions reduction strategy and doesn't have a flash emission capturing unit in place. LPRC also doesn't have a blanket line system which is a recycling line between the storage tank and the transport tank. However, it has an automatic high vapor alarm system and a valve maintenance system. LPRC is currently expanding to Buchanan and controls 30 tanks across the country: twelve of its own and 18 others that belong to Bea Mountain, China Union, and others.

2.5 Transport Sector

2.5.1 National Transport Policy and Strategy (NTPS), 2009

The NTPS (2009) was the first of its kind for the sector in Liberia, and it held promise for Liberia's plans to reduce emissions from the transport sector. The NTPS needs to be updated. However, it has at its core the goal of providing efficient transport services. The long-term strategy for the transport sector is the creation of a modern railway and water transport system. This would require significant investment, which the government is currently unable to afford. Over the immediate to mid-term, the strategy provides for other measures like requiring all vehicles to have catalytic converters to reduce pollution. The NTPS seeks to accomplish these objectives by:

- ✓ Implementation of the National Transport Master Plan and a periodic revision every five years. There is a need to assess the standards that MoT has on old vehicles and tariffs in coordination with the Ministry of Commerce (MOC) and Liberia Revenue Authority (LRA).
- ✓ The Ministry of Transport (MoT) and the Ministry of Public Works (MPW) are to establish an effective Road Maintenance Management System.

2.5.2 National Transport Master Plan (NTMP), 2012

The principal target of the NTMP is to present guidelines for rehabilitating and developing transportation infrastructure and services so that a networking of individual transport systems will lead to the generation of greater economic and social benefits. It has the aim of creating a comprehensive, flexible, and integrated system which incorporates the potentials of each transportation mode in the context of needs and capabilities of the economy as a whole.

- ✓ The NTMP has not been updated since the initial one in 2012. An updated Plan can be a good opportunity for mainstreaming emissions reduction targets to include the promotion of mass transit and electric vehicles, better traffic control, and water and rail transit through increased private investments and increased capacity for transportation planning. The new masterplan is called the Multi-model Masterplan, which is still in draft.

2.5.3 National Transit Authority (NTA) Act, 2007

NTA provides national public transport (bus services). The NTA can provide data for the transport sector, and promote an efficient mass transit system. The NTA can also play a role in promoting investments in water and rail transit and set industry standards.

3.0 Building Block 1: National Methane Emission Sources

Globally, Methane is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices, land use, and by the decay of organic waste in municipal solid waste landfills. Liberia falls within the later, as agriculture and land use, waste landfill and fossil fuel use for transport and energy generation are mainly responsible for Liberia's methane production.

3.2 Liberia's First Biennial Report to the UNFCCC (2020)

	Gg	MtCO2e
Total National Methane (CH4) Emissions (2017)	40.82	0.04082
1 - Waste	21.92	0.02192
4.A - Solid Waste Disposal	11.50	0.0115
4.B - Biological Treatment of Solid Waste	-	
4.C - Incineration and Open Burning of Waste	-	
4.D - Wastewater Treatment and Discharge	10.42	0.01042
2 - Agriculture, Forestry, and Other Land Use	7.67	0.00767
3.A - Livestock	6.00	0.006
3.B - Land		
3.C - Aggregate sources and non-CO2 emissions sources on land	1.67	0.00167
3.D - Other	-	
3 - Energy	11.23	0.01123
1.A - Fuel Combustion Activities	11.23	0.01123
1.B - Fugitive emissions from fuels	-	
1.C - Carbon dioxide Transport and Storage		
4 - Industrial Processes and Product Use	-	
2.A - Mineral Industry	-	
2.B - Chemical Industry	-	
2.C - Metal Industry	-	
2.D - Non-Energy Products from Fuels and Solvent Use	-	
2.E - Electronics Industry	-	
2.F - Product Uses as Substitutes for Ozone Depleting Substances		
2.G - Other Product Manufacture and Use	-	
2.H - Other	-	

3.2 Methane Emission Sources by Sectors and Activities

Solid waste and wastewater management

a. Monrovia collects 300-350 tons and Paynesville collects 90-100 tons of solid waste per day:
    - Organic (52.4%)
    - Plastic (14.2%)
    - Glass/ceramics (10.5%)
    - Rubber (10%)
    - Batteries (9.9)
    - Metals (3%)

a. But there is only one landfill which has been overused, and limited transfer centers leaving piles of garbage on the streets
b. Many households are not paying for waste collection on a regular basis, and waste collection policies are not being adequately enforced
c. Palm plantations contribute to methane emissions but data needs to be collected on the exact amount. Empty fruit branches (EFBs) can be used for composting.
d. Before the civil war, Liberia Water and Sewer Corporation (LWSC) was using an anaerobic system to digest the organic pollutants in the wastewater, producing biogas as a byproduct. As part of the anaerobic system, the biogas is primarily made up of methane and carbon dioxide, which can be used as a renewable energy source.
e. But since the civil crisis, LWSC has been using an aerobic system that involves trucks vacuuming the waste water from the sewer system and taking it to a LWSC site in Monrovia and dumping it into the sedimentation pond where the solid is separated from the liquid. The liquid is wasted into the wetlands and the solid stays out where the sun cakes it up and people use it as natural fertilizer. There is also an open sewage drainage at Sonnyway in Monrovia that goes straight into the ocean.
f. A combination of the above is why 0.02192 MtCO2e of methane is emitted from the waste sector.

Agriculture Sector

2. **Livestock farming**
    a. The limited stock of goats, sheep, and cows does not supply an adequate amount of protein for the Liberian diet, but poultry farming and marketing of eggs are on the increase. In 2001, there were an estimated 5,000,000 chickens, 220,000 goats, 210,000 sheep, 130,000 pigs, and 36,000 cattle[8] in Liberia.
    b. There is a policy push to promote livestock rearing in Liberia's coastal areas in the southeastern region. It is worth noting that animals move around on a free range in Liberia, thereby increasing the risks of conflicts with other land users like crop farmers. Attempts to keep animals in enclosures will lead to the buildup of animal feces due to there being very limited awareness and programs to manage animal feces. Hence, .006 MtCO2e of methane, or more, will still be emitted by the livestock sector if measures are not put in place.

[8] https://www.nationsencyclopedia.com/Africa/Liberia-ANIMAL-HUSBANDRY.html

3. **Paddy Rice Production**
    a. Under common rice production practices, farmers keep rice fields flooded to suppress weed emergence. Underwater, methane is produced as organic matters decay with little access to oxygen.
    b. In Liberia, as in many developing countries, the demand for rice exceeds local production capacity. As a result, Liberia must import approximately 85 percent of its annual consumption of 150,000 metric tons (mt). Reducing dependence on imports remains one of Liberia's primary development challenges, although the trade-offs could result in increased methane emissions and water pollution. While this may be already happening, limited data exists to make a conclusive estimate of the extent of emissions from paddy rice production.
    c. In its National Agriculture Development Plan (NADP) the MoA plans to cultivate 50,000 hectares for rice farming.
    d. This means the .00167 MtCO2e of methane that is being emitted from rice paddy farming will most likely increase if measures are not put in place.

Energy/Transport Sectors

4. **Fuel combustion emission from vehicles older than 10 years and generators supplying energy to households and businesses**
    a. Information on the number of cars older than 10 years being driven in Liberia is not available. Some information point to 50% of all cars in Liberia are older than 10 years.
    b. Many people still use generators because Liberia's hydroelectricity system only supplies 50% of its consumer base and the solar industry is still gradually growing.
    c. Hence, 0.01123 MtCO2e of methane, or more, will still be emitted by the energy and transport sectors if measures are not put in place

4.0 Building Block 2: Analytics and Mitigation Measures Assessment

4.1 Waste Sector Mitigation Measures

In the Waste sector, Liberia commits to the following mitigation measures to reduce methane emissions from 0.02192 MtCO2e to 0.01526 MtCO2e below BAU level by 2030 (a reduction of 0.18648 MtCO2e):

- Conduct comprehensive assessments to identify suitable locations for landfill sites, considering factors such as proximity to population centers, geological suitability, and environmental impact
- Develop 5 new transfer stations and 3 new landfills in Montserrado and Margibi Counties
- Enforce the Polluter Pay Policy (PPP) so that households, the Liberia Marketing Association, and other businesses are compelled to pay for the collection of their waste, and Community Based Enterprises (CBEs) can make enough money to continue collecting waste
- Provide 300,000 durable/single waste bags for households in support of waste separation before it is collected by CBEs
- Establish an incentives program that buys plastic waste from people as a way to encourage them to separate waste, and also establish an incentives program that pays CBEs based on the amount of waste that they take to the transfer stations to encourage them to collect more waste
- Establish a payment system that requires all property owners to pay for waste collection and they can include the cost in the rent money they have renters. Properties should be in a database. City governments should conduct property mapping.
- EPA and the Municipal Authorities including MCC and PCC should focus on providing communities with standard waste collection services so the people can be encouraged to continue paying for waste collection
- Return to the anaerobic system wastewater management system to digest the organic pollutants in the wastewater, producing biogas as a byproduct
- Develop one (1) recycling plant that will separate waste that is not separated at the household level, and use organic waste to produce compost and plastic waste to recycle new plastic products
- Develop and enforce a policy or regulation on recycling plastic, organic, and electronic waste
- Assess the potential for the utilization of captured or recovered methane gas
- Support the implementation of a Municipal Waste landfill gas capture, recovery, management, monitoring, and verification system for Whein Town, Cheesemanburg, and other landfills across the country (yet to be established), which should include the construction of gas ventilation systems on each landfill surface
- Review all Municipal Ordinances to ensure that the Solid Waste Management Policy is integrated in them

- Integrate waste management modules or courses into existing primary, secondary, vocational, and skills training programs, covering topics such as waste segregation, recycling techniques, composting, and hazardous waste handling
- Create awareness on methane emissions from the waste sector (a 6-year campaign using radio, community outreach, and social media)
- Encourage the private sector to invest in waste management which has the potential to employ more than 30,000 Liberians, sell compost and recycled plastic products such as plastic construction bricks.
- Convert the Whein Town landfill into a material recovery facility with a transfer station and methane gas harvesting station
- Upgrade the Cheesemanburg landfill plan into a regional facility servicing several municipalities (a sanitation park)
- Incentives should be provided to women to increase their participation in solid waste management initiatives such as loans or grants for recycling, composting, bio digester maintenance, and biogas utilization for household needs

4.2 Agriculture Sector Mitigation Measures

In the Agriculture sector, Liberia commits to the following mitigation measures to reduce methane emissions from 0.00767 MtCO2e to 0.004 MtCO2e Gg below BAU levels by 2030 (a reduction of 0.10276 MtCO2e) from livestock raising and rice patty farming:

Livestock

- Improve feed management in cattle ranches by feeding the cattle with at least 60% grains to reduce the methane content in livestock feces (grow maize)
- Encourage integrated livestock and crop farming across seven major cattle ranches
- Promote rotational grazing across the seven major cattle ranches
- Promote the use of biogas for energy production by developing seven (7) biogas production plants at seven (7) major cattle ranches across the country
- Develop and operationalize at least one (1) regulation for methane management at slaughter houses across the country
- Strengthen the capacity of at least five hundred (500) livestock farmers in pasture management such as fencing techniques, and climate smart cattle rearing including piggery and poultry farming e.g., workshops and on-farm demonstrations
- Through loans and grants, women should receive access to resources in order to have ownership of livestock, slaughter houses, rice farms, and land

Rice Farming

- Promote Alternate Wetting and Drying (AWD) in at least 30% of the 50,000 hectares of irrigated fields that the Ministry of Agriculture plans to cultivate
- Procure and supply at least one (1) solar dryer each for one hundred (100) Farmer Based Organizations (FBOs) that comprises 25-50 members each
- Develop and operationalize water management regulations that promote the use of AWD to conserve water resources and reduce methane emissions from rice paddy farms
- Develop a program for the Training of Trainers (ToT) on low-emission approaches such as the use of AWD and solar dryers for smallholder farmers, farming cooperatives, Farmer Based Organizations, Agronomists, and extension agricultural workers/agents in their operations reaching at least one thousand (1,000) people
- Improve post-harvest practices by at least 30% of paddy fields to mitigate methane emissions
- Women should receive equal access to training in low emissions approaches to agriculture development as their male counterparts

4.3 Energy and Transport Mitigation Measures

In the Energy and Transport sectors, Liberia commits to the following mitigation measures to reduce methane emissions from 0.01123 MtCO2e to 0.0669 MtCO2e below BAU level by 2030 (a reduction of 0.00454 MtCO2e)

Transport

- Implement enforcement mechanisms at Liberia's 76 ports of entry including the Freeport of Monrovia by increasing the tax on vehicles older than 10 years.
- Develop and implement a strategy to permanently phase out the importation of vehicles older than ten (10) years
- Introduce a device to measure how much methane vehicles are emitting, establish a threshold for maximum emissions per vehicle, and fine those vehicle owners whose cars fail the test
- Encourage the importation of Electric Vehicles (EVs) by adopting public procurement policies that prioritize the purchase of electric, solar, and biofuel vehicles for government entities.
- Develop EV policy to sustain investment in EVs and guide the use of EVs, where they can move, how much they can be taxed and the incentives for EV owners
- Encourage the importation of cleaner fuel options such as low-sulfur diesel and biofuels.

- Upgrade the current motor vehicle data collection system so that information on men, women, and youth are disaggregated to know, for example, if women are more likely to own cars older than 10 years or not
- The Ministry of Transport should consider the potential for gender disparities in car ownership, access to public transportation, and impact of fuel taxes. Women could be disproportionately affected by higher taxes on used cars if they are more likely to own older vehicles. To address this situation, we can explore policy solutions that address unequal access to transportation and promote mobility options for women.

Energy

- Explore opportunities for integrating renewable energy sources, such as solar, wind, and hydroelectric power into LEC's expansion plans
- Allocate funds for the expansion of electricity infrastructure, including transmission lines, substations, and distribution networks to connect additional municipalities to the LEC grid.
- Develop separate emissions factors for the energy and transport sectors
- Expand grid electrification to 5 counties working with LEC and other private companies
- Through the St. Paul 2 project (World Bank), ensure that Bong, Margibi, Montserrado, Bomi, Cape Mount, and Gbarpolu Counties are electrified on the LEC hydroelectric grid
- Expand renewable energy access in five (5) districts in Lofa county
- Expand hydro power in parts of Nimba, Bong, River Gee, and Maryland counties
- Electrify 90 public health facilities through stand-alone solar systems across the country

5.0 Building Block 3: Data Collection and Targets

5.1 Overview of Data Collection Strategy

Building Block 3 of the M-RAP primarily focuses on establishing measurable targets, and ensuring accurate methane emissions data collection, monitoring, reporting, and verification across key sectors: agriculture, waste, energy, and transportation. This section is crucial for setting a robust foundation to guide Liberia's methane mitigation efforts effectively. It emphasizes compliance with the Intergovernmental Panel on Climate Change (IPCC) and ensures that data aligns with international standards for transparency and accuracy.

Data requirements focus on livestock, rice paddies, waste disposal, and energy/transportation emissions. Methane reduction indicators include methane emissions capture and improved management practices. As per best practices in data collection, the different sectors should be specifically isolated.

5.2 IPCC Guidelines

By adhering to the International Panel on Climate Change (IPCC) guidelines, the Methane Roadmap will be positioned to not only provide a comprehensive and accurate picture of national methane emissions but also to integrate effectively with international efforts to combat climate change. This structured approach will ensure the robustness and reliability of the methane emission data, which is essential for developing effective mitigation strategies.

5.3 Specific Data Collection Requirements for Agriculture

- Collect detailed data on livestock numbers, manure management systems, and rice paddy cultivation practices
- For agricultural and Land Use, Land Use Change, and Forestry (LULUCF) sectors, use satellite imagery and remote sensing for area measurement and change detection.
- Quantity of methane emissions from livestock, rice paddies, and use of synthetic fertilizers.
- Numbers and types of animals, manure management practices. Collect data on animal numbers by category (dairy cows, beef cattle, swine, poultry, etc.).
- Collect information on manure management systems (storage and treatment technologies)
- Focus on the types of crops and the areas where they are planted, particularly rice, and consider cultivation practices e.g., continuous flooding and intermittent flooding

Table 1. National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol and the greenhouse gases' precursors

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4 (Gg)
Agriculture	X
A. Enteric fermentation	X
B. Manure management	X

C. Rice cultivation	X
D. Agriculture soils	X
E. Prescribed burning of savannahs	X
F. Field burning of agricultural residues	X
G. Other (please specify)	X

The specific tasks of the Agriculture sector working group will be to estimate emissions in the following source categories within the Agriculture sector. Methane gas should be covered under the various sub-sectors indicated below:

Enteric fermentation

- **a.** Cattle
- **b.** Buffalo
- **c.** Sheep
- **d.** Goats
- **e.** Camel and Llamas
- **f.** Horses
- **g.** Mules and Asses
- **h.** Swine
- **i.** Poultry
- **j.** Other (please specific)

Manure Management

a. Cattle
b. Buffalo
c. Sheep
d. Goats
e. Camel and Llamas
f. Horses
g. Mules and Asses
h. Swine
i. Poultry
j. Anaerobic
k. Liquid systems
l. Solid Storage and Dry Lot
m. Other (please specify)

Rice Cultivation

a. Irrigated
b. Rainfed
c. Deep water
d. Other (please specify)

Field burning of agricultural residues

a. Cereals
b. Pulse
c. Tuber and Root
d. Sugar Cane
e. Other (please specify)

5.4 Specific Data Collection Requirements for Waste

- Focus on solid waste generation rates, composition, methane capture, recovery systems from landfills, and wastewater treatment
- Use direct measurements where possible, such as flux chambers for landfill methane emissions.
- Municipal Solid Waste (MSW) Data (quantities of waste generated, collected, and processed; composition of waste)
- Wastewater data (volume and treatment method of industrial and residential water
- Data on waste generation rates, composition, disposal methods (landfill, incineration, recycling)
- Methane recovery systems and flare data
- Volumes of domestic and industrial wastewater
- Treatment methods, efficiency and the implementation of anaerobic processes

Table 2. National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal protocol'' and greenhouse gases precursors

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4 (Gg)
Waste	X
A. Solid waste disposal on land	X
B. Waste water handling	X
C. Waste incineration	
D. Other (please specify)	X

Notes: Shaded cell do not require entries.

The specific tasks of the Waste sector working group will be to estimate emissions in the following source categories within the Waste sector. Methane gas should be covered under the various sub-sectors are indicated below:

Solid waste (waste management)

a. Solid waste disposal on land
b. Managed waste disposal on Land
c. Unmanaged waste disposal on sites
d. Other (please specify)

Liquid waste (Waste-water handling)

a. Industrial waste water
b. Domestic and commercial waste water
c. Waste incineration
d. Other (please specify)

5.5 Specific Data Collection Requirements for Energy and Transport

- Emphasize fuel consumption, emission factors, fugitive emissions from fuels, energy efficiency, and alternative fuel adoption
- Focus on the type and quantity of fuels used in energy production and in the transportation sector, including renewables
- Collect data on emissions from power plants, oil and gas extraction, and processing facilities (even though Liberia is not yet extracting nor processing oil and gas)
- Collect data on emissions from different types of vehicles (light-duty and heavy-duty) especially those older than 10 years
- Fuel consumption data by type (coal, natural gas, oil) and sector (residential, commercial, industrial)
- Emission factors specific to fuel types and combustion technologies
- Data on losses from extraction, transport, and distribution of oil and gas

Table 3a. National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal protocol and greenhouse gases precursors

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4 (Gg)
Energy and Transport	X
A. Fuel combustion (sectoral approach)	X
B. Energy industries	X
C. Manufacturing industries and construction	X
I. Transportation	X
II. Fugitive emissions from fuels	X
III. Solid fuels	X
IV. Oil and natural gas	X
V. Other sectors (please specify)	X

Table 3b. National greenhouse gas inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal protocol and greenhouse gases precursors

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	CH_4 (Gg)
Memo items	
International bunkers	X
Aviation	X
Marine	X
CO_2 emissions from biomass	

Notes: Shaded cell do not require entries.

The specific tasks of the Energy/Transportation sector working group will be to estimate emissions in the following source categories within the Energy/Transportation sector. Methane gas should be covered under the various sub-sectors are indicated below:

Fuel combustion activities (sectoral)

1. ***Energy industries***

a) Public electricity and heat production
b) Petroleum refining
c) Manufacture of solid fuels and other energy

2. ***Manufacture and construction industries***

a) Iron and steel
b) Nonferrous metals
c) Chemical
d) Pulp, paper and print
e) Food processing, beverages and tobacco

3. ***Transportation***

a) Civil aviation
b) Road transportation

c) Railway
d) Navigation
e) Others (please specify)

4. Other sectors

a) Commercial, institutional, and residential
b) Residential
c) Agriculture, forestry and fishing

Fugitive emissions from fuels:

1. Solid fuels

a) Coal mining
b) Solid fuel transformation
c) Others (please specify)

2. Oil and natural gas

a) Oil
b) Natural gas
c) Vent and flaring

Memo items

Emissions that should be reported separately and not included in the energy totals.

International bunkers

a. Aviation
b. Marine

General Environmental Data

- **Air Quality Data:** Levels of air pollutants including methane as a precursor to ground-level ozone
- **Climate Data:** Temperature, precipitation, and other relevant climate variables that affect methane emissions

Collection Methods

- Implement continuous monitoring systems for key sources like large ruminant farms or major waste treatment facilities
- Implement direct measurement systems and satellite imagery for accurate monitoring
- Conduct rigorous IPCC-recommended independent audits and regular data verification
- Develop a national Measuring, Reporting, and Verification (MRV) system to ensure transparency and compliance
- Train personnel in inventory methodologies and conduct workshops for stakeholders on methane measurement and mitigation

- Align efforts with the Global Methane Pledge and Sustainable Development Goals (SDGs) for integration with international frameworks. However, from Liberia's national circumstances, secondary/tertiary data can be used since there are challenges in obtaining primary data.
- For the efficient implementation of the Methane Roadmap, it's crucial that these types of data are collected, shared, and analyzed by the relevant ministries and agencies (working groups).

Emissions Calculation Formula

$$E = EF \bullet AD$$

Where **E** = Emission, **EF** = Emission Factor, and **AD** = Activity Data

3. Data Sharing Protocols

- Establish secure digital platforms for data sharing between agencies (*there are two data sharing platforms at the EPA, namely: EKMS and CCKSP, but not sure whether they are fully operational*)
- Regular training sessions on data entry, analysis, and reporting based on IPCC guidelines.
- Develop standardized templates and reporting formats to ensure consistency and accuracy

4. Quality Assurance and Quality Control (QA/QC)

- Implement rigorous QA/QC procedures as recommended by the IPCC, including internal and external reviews
- Conduct periodic verification of data through independent audits
- Use control charts and error tracking logs to monitor data quality over time

5. Reporting and Verification

- Align reporting formats with the IPCC's Common Reporting Format (CRF) to facilitate international reporting and comparison
- Engage in international peer review processes to enhance transparency and credibility
- Develop a national MRV (Measuring, Reporting, and Verification) system that integrates methane emissions tracking into broader environmental performance metrics

6. Capacity Building

- Train staff in IPCC inventory methodologies, focusing on sector-specific guidelines
- Organize workshops and seminars to update stakeholders on new methodologies and technologies for methane measurement and reduction

6.0 Building Block 4: Implementation pathways for priority measures

6.1 Waste Sector Actions

Overall Methane Reduction Goal/Target	In the Waste sector, Liberia commits to the following mitigation measures to reduce methane emissions from 0.02192 MtCO2e to 0.01526 MtCO2e below BAU level by 2030 (a reduction of 0.18648 MtCO2e):								
Actions	**Responsible Institutions**	**Barriers**	**Means of overcoming the barriers**	**Regulatory instruments**	**Means of Finance**	**Indicator**	**Implementation time/schedule**		**Means of Verification**
							Start	**End**	
Action 1: Conduct comprehensive assessments to identify suitable locations for landfill sites, considering factors such as proximity to population centers, geological suitability, and environmental impact	EPA, MCC, PCC, other municipalities, MIA, academic institutions, MFDP	Inadequate/limited financial resources	Invest in innovative financing strategy	EPA policy and legal framework, City Ordinance/regulations, the ARREST Agenda, NDC	National support, Donor support	Number of potential sites identified	2025	2026	Assessment Reports

Action 2: Develop 5 new transfer stations and 3 new landfills in Montserrado and Margibi Counties	MCC, PCC, MIA, other municipalities, MFDP, EPA	Financial constraints	Political will to take funds from the national budget, donor support	National Solid Waste Management Policy	National and donor funding	Number of new transfer stations and landfills in Montserrado and Margibi Counties	2025	2030	Constructed and functional transfer stations and landfills
Action 3: Enforce the Polluter Pay Policy (PPP) so that households, the Liberia Marketing Association and other businesses are compelled to pay for the collection of their waste, and CBEs can make money to continue collecting waste	MCC, PCC, MIA, other municipalities, EPA	Low political will, City Corporations collect money from the Liberia Marketing Association but don't manage their waste properly	Intense advocacy at the National Legislature and the President's office The solid waste sector should be legislated to compel residents and schools to pay for waste collection. Currently, only businesses and clinics are compelled to pay for	National Solid Waste Management Policy	National funding	Amount of revenues collected	2025	2029	Financial reports from SMEs and CBEs

			waste collection						
Action 4: Provide 300,000 durable/single waste bags for households to support waste separation to be collected by tricycles	MCC, PCC, other Municipalities, MIA, EPA, MFDP	Financial constraints	Convince the relevant government institutions that investing in the waste bags will bring returns such as waste being separated before going to the transfer stations or landfills, and this will create more materials for composting and plastic recycling	National Solid Waste Management Policy	National and donor funding	Number of waste bags procured and supplied to households	2025	2028	Receiving notes
Action 5: Establish an incentives program that buys plastic waste from people as a way to encourage	MCC, PCC, other municipalities, private sector	The private sector companies that by plastic are not buying enough plastic waste	The private sector companies buy more plastic waste	National Solid Waste Management Policy	National and donor funding	Amount of plastic was bought through the incentives program	2025	2030	Financial reports from CBEs, receiving notes

them to separate waste and pays CBEs based on the amount of waste that they take to the transfer stations									
Action 6: Establish a payment system wherein, people who are renting pay for waste collection through the property owner	MCC, PCC, other municipalities, MFDP, LEC, LWSC	Limited innovations to move the waste sector forward	Consider innovative ways to drive the waste sector such as a payment system embedding into an existing payment system	National Solid Waste Management Policy	National funding	The amount of money generated through the household payment system	2025	2028	Financial reports, fully functional payment system either exclusive to waste collection payments or inclusive of same
Action 7: Develop one (1) recycling plant that will separate waste that is not separated at the household level, and will produce compost and recycle plastic	MCC, PCC, other municipalities, MFDP, the private sector	Financial constraints	Engage the government and private sector to invest in a recycling plant	National Solid Waste Management Policy	National and donor funding	Number of recycling plants	2025	2029	A fully functional recycling plant that separates organic, plastic and other waste

Action 8: Develop and enforce a policy or regulation on recycling plastic, organic, and electronic waste	MCC, PCC, other Municipalities, MIA, EPA	Low political will	Engage and inform the Office of the President and Legislature on the benefits of having a policy on recycling plastic, organic, and electronic waste	National Solid Waste Management Policy	National funding	Number of policies on recycling waste	2025	2027	An approved regulation on recycling waste
Action 9: Support the implementation of a municipal waste landfill gas recovery, management, monitoring, and verification system at Whein Town, Cheesemanburg, and other landfills across the country	EPA, MCC, PCC, MFDP	Inadequate technical capacity and technologies, financial constraints, poor interagency coordination	Support capacity-building initiatives and technology transfer, source private sector investment, and establish mechanism for interagency coordination	EPA policy and legal framework, the ARREST Agenda, NDC	Donor Support required	MtCO2e emitted from landfill gas system - Whein Town and Cheesemanburg	2024	2030	Annual Reports, Sites visitations

Action 10: Assessment of the potential for utilization of captured gas at landfill sites, if feasible	EPA, MCC, PCC, academic institutions, MFDP	Limited financial capacity	Seek private-sector investment	EPA policy and legal framework City Ordinance/regulation, the ARREST Agenda, NDC,	National support, donor support	Number of assessments conducted	2024	2025	Reports
Action 11: Review of Municipal Ordinances in order to update them	EPA, MCC & PCC, academic institutions, MFDP	Institutions' failure to prioritize	Prioritize and invest time and resources to review	EPA policy and legal framework, City Ordinance/regulation, the ARREST Agenda, NDC	National support	Number of Municipal Ordinance reviewed	2027	2027	Reports
Action 12: Integrate waste management modules or courses into existing primary, secondary, vocational and skills training programs, covering topics such as waste segregation, recycling techniques, composting,	EPA, MCC & PCC, academic institutions, Ministry of Education	Limited Financing	Seek innovative financing strategies	EPA policy and legal framework, City Ordinance/regulation, the ARREST Agenda, NDC	National Financing	Updated curriculum	2025	2030	Reports, curriculums

and hazardous waste handling									
Action 13: Create awareness, educate, and sensitize the population about methane (CH4) emissions from the waste sector	EPA, MCC & PCC, academic, NGOs, private sector	Limited funding	Invest in innovative awareness raising initiative	EPA policy and legal framework, City Ordinance/regulation, the ARREST Agenda, NDC	National Financing	Number of awareness messages developed, Number of awareness campaigns rolled out	2024	2030	Activity reports
Action 14: Convert the Whein Town landfill into a material recovery facility with a transfer station and methane gas harvesting station	MCC, PCC, EPA, MFDP	Financial constraints	Engage the Office of the President and the Legislature to invest in this facility that could improve the waste management sector	National Solid Waste Management Policy	National and donor funding	Number of material recovery facilities	2025	2029	A fully functional material recovery facility
Action 15: Upgrade Cheesemanburg landfill into a regional facility servicing several municipalities	MCC, PCC, EPA, MFDP	Government counterpart funding is a challenge	Identify an investor or donor to provide 22 million USD	National Solid Waste Management Policy	National and donor funding	Number of regional landfill facilities	2025	2030	A fully functional regional landfill facility

Action 16: Encourage the private sector to invest in waste management which has the potential to employ more than 30,000 Liberians, sell compost and recycled plastic products such as plastic construction bricks	MCC, PCC, other municipalities, National Investment Commission, MFDP	Low incentives to invest in the waste sector Bribery and corruption that discourage investors	Provide incentives that will encourage investment in the waste sector Ensure that government officials don't ask investors for bribes when processing their investments Facilitate capacity building, access to microloans, grants, and investment opportunities to enable CBEs, SMEs, and focal points to invest in solid waste management infrastructure,	National Solid Waste Management Policy, NIC Act, Labor Law	National and private sector investment	Number of new jobs created and occupied in the waste sector Number of new waste sector companies established Number or value of loans and grants provided to SMEs and CBEs in the waste sector Number of new waste management infrastructure built Number of waste sector businesses expanded	2025	2030	Reports

			equipment, and business expansion initiatives						
Action 17: Integrate gender considerations into waste management policies, institutional frameworks, and decision-making processes to address gender disparities, promote equality, and ensure meaningful participation	MCC, PCC, other municipalities, MIA, EPA, Ministry of Gender	Willingness of women and youth to work in the waste sector	Encourage women and youth to work in the waste sector	National Solid Waste Management Policy, National Gender Policy	National and donor funding	Number of new women and youth employed in the waste sector, number of policies that enhance women and youth participation in waste management	2025	2030	Reports

6.2 Agriculture Sector I – Livestock farming

Goal	To reduce methane emissions caused by livestock farming from 0.006 MtCO2e to 0.003 MtCO2e below BAU levels by 2030 (a reduction of 0.003 MtCO2e), Liberia commits to the following mitigation measures and targets:								
Actions	**Responsible Institutions**	**Barriers**	**Means of overcoming the barriers**	**Regulatory instruments**	**Means of Finance**	**Indicator (s)**	**Implementation time/schedule**		**Means of Verification**
							Start	**End**	
Action 1. Improve feed management in cattle ranches by feeding the cattle with at least 60% grains	MoA, EPA, CARI, MFDP, academic institutions, private sector actors	Limited incentives and financial resources Limited awareness on CH4 emission from livestock	Invest in incentives for farmers to produce more grain for cattle feed Explore innovative financing strategies Increase awareness of livestock farmers on CH4 emission from livestock	NADP, Roadmap for Rangeland Restoration, NDC, NAP, NCCPS, EPA Act	National funding and donor support	Amount of CH4 emission avoided from cattle feces Number of cattle ranches feeding cattle with at least 60% grains Quantity of grains produced	2024	2030	Reports., site inspections

						for each/all cattle ranches			
Action 2. Encourage integrated livestock and crop farming across seven major cattle ranches	MoA, EPA, CARI, MFDP, academic institutions, private sector actors	Limited knowledge, capacity, and incentives/finance to do integrated livestock and crop farming	Invest in technical and material support for integrated livestock and crop farming across seven major cattle ranches	NADP, Roadmap for Rangeland Restoration, NDC, NAP, NCCPS, EPA Act	National funding and donor support	Amount of CH4 emission avoided Number of cattle ranches practicing integrated livestock and crop farming	2024	2030	Reports., site inspections
Action 3. Promote rotational grazing across the seven major cattle ranches	MoA, EPA, CARI, MFDP, academic institutions, private sector actors	Limited knowledge, capacity, and incentives/finance to do rotational grazing activities	Invest in technical and material support for rotational grazing activities across seven major cattle ranches	NADP, Roadmap for Rangeland Restoration, NDC, NAP, NCCPS, EPA Act	National funding and donor support	Amount of CH4 emission avoided Number of cattle ranches practicing rotational grazing	2024	2030	Reports, site inspections
Action 4. Promote the use of biogas for energy production by developing 7 biogas production plants at seven major cattle	MoA, EPA, MME, CARI, MFDP, academic institutions, private sector actors	Limited incentives and financial resources	Invest in technical and material support for the development of biogas production	NADP, Roadmap for Rangeland Restoration, NDC, NAP,	National funding and donor support	Amount of CH4 emission avoided Number of cattle	2024	2030	Reports, site inspections

ranches across the country		Limited awareness on the conversion of livestock feces for biogas and the use of biogas for energy production	plants across seven major cattle ranches	NCCPS, EPA Act		ranches with biogas production plants			
Action 5. Develop and operationalize at least 1 regulation for methane management at slaughter houses across the country	MoA and EPA	Limited political will to develop regulations in a timely manner Limited resources to operationalize regulations	Increase awareness among policy makers on methane emissions and the management of slaughter houses Provide financial support and incentives for the operationalization of the regulation	NADP, Roadmap for Rangeland Restoration, NDC, NAP, NCCPS, EPA Act	National funding and donor support	Amount of CH4 emission avoided Number of regulations for methane management at slaughter houses developed and operationalized	2024	2030	Regulation, site inspection reports
Action 6: Strengthen the capacity of at least 500 livestock	MoA, EPA, CARI, MFDP, academic institutions,	Limited financial and material resources to	Provide financial and material	NADP, Roadmap for Rangeland Restoration,	National funding and	Amount of CH4	2024	2030	Reports of farmers practicing sustainable

farmers in pasture management such as fencing techniques and sustainable and climate smart cattle rearing including piggery and poultry farming e.g., workshops and on-farm demonstrations	private sector actors	conduct the training Limited incentives for farmers to practice what they learn in the training	support for the training Provide incentives for farmers to adopt best practices	NDC, NAP, NCCPS, EPA Act	donor support	emission avoided Number of farmers trained in fencing techniques and sustainable and climate smart cattle rearing including piggery and poultry farming			cattle rearing

6.3 Agriculture Sector II – Rice Farming

Goal	To reduce methane emissions caused by rice paddy farming from 0.00167 MtCO2e to 0.001 MtCO2e below BAU levels by 2030 (a reduction of .00067 MtCO2e, Liberia commits to the following mitigation targets:								
Actions	**Responsible Institutions**	**Barriers**	**Means of overcoming the barriers**	**Regulatory instruments**	**Means of Finance**	**Indicator**	**Implementation time/schedule**		**Means of Verification**
							Start	**End**	
Action 1. Promote Alternate Wetting and Drying (AWD) in at least 30% of 50,000 hectares of irrigated rice paddy fields according to the National Agriculture Development Plan	MoA, EPA, CARI, MFDP, academic institutions, private sector actors	Limited incentives and financial resources Limited awareness on CH4 emission from paddy rice farming	Invest in incentives for farmers to use AWD Explore innovative financing strategies Increase awareness of paddy rice farmers on CH4 emissions from watering rice fields	NDC, NADP, NAP, NCCPS, EPA Act	National funding and donor support	Amount of CH4 emission avoided Number of irrigated fields within the 50,000 hectares of irrigated fields using AWD	2024	2030	Reports., site inspections
Action 2.: Procure and supply at least one solar dryer each for 100 Farmer Based Organizations	MoA, EPA, CARI, MFDP, Academic institutions, private sector, CSOs	Inadequate financial resources, Limited knowledge on the use of solar dryers	Invest in solar dryers Explore innovative financing strategies	NADP, NDC, NADP, NAP, NCCPS, EPA Act	National Funding and donor support	Number of solar dryers procured and supplied	2025	2030	Reports. Site inspections

(FBOs) 25-50 members each	Farmer's Group	Limited awareness on CH4 emission from paddy rice drying	Increase awareness of paddy rice farmers on CH4 emissions from paddy rice drying						
Action 3: Develop and operationalize water management regulations that promote the use of AWD to conserve water resources and reduce methane emissions from rice paddy farms.	MOA and EPA	Limited political will to develop regulations in a timely manner Limited resources to operationalize regulations	Increase awareness among policy makers on methane emissions from the watering of rice paddy fields Provide financial support and incentives for the operationalization of the regulation	NADP, NDC, NADP, NAP, NCCPS, EPA Act	National Funding and donor support	Amount of CH4 emission avoided Number of regulations for proper water management of rice paddy fields developed and operationalized	2024	2030	Regulation, site inspection reports
Action 4: Develop program for Training of Trainers on low-emission approaches such as the use of AWD and	MoA, EPA, CARI, MFDP, academic institutions,	Limited financial and material resources to conduct the training	Provide financial and material support for the training	NADP, NDC, NAP, NCCPS, EPA Act	National funding and donor support	Amount of CH4 emission avoided Number of farmers	2024	2030	Reports of farmers practicing AWD and solar dryers

solar dryers for smallholder farmers, farming cooperatives, Farmers Based Organizations, Agronomist, extension agricultural workers/agents in their operations reaching at least 1,000 people.	private sector actors	Limited incentives for farmers to practice what they learn in the training	Provide incentives for farmers to adopt best practices			trained in the use of AWD and solar dryers			
Action 5. Improve post-harvest practices by at least 30% of paddy fields to mitigate methane emissions	MoA, EPA, CARI, MFDP, academic institutions, private sector, CSOs, LISGIS	Inadequate financial resources, limited and sub-national capacity, limited technology	National capacity-building initiatives and innovative financing strategy, invest in technology transfer	NADP, NDC, NADP, NAP, NCCPS, EPA Act	National funding and donor support	Amount of CH4 emission avoided Number of rice paddy fields with improved post-harvest practices	2024	2030	Reports, site inspections
Action 6. Improve post-harvest management by 10% to curtail emissions from decomposition during transportation and storage	MoA, EPA, CARI, MFDP, academic institutions private sector	Inadequate technical capacity, limited financial resources,	Invest in capacity-building initiatives at all levels, seek innovative	NDC, NADP, NAP, NCCPS, EPA Act	National funding and donor support	Amount of CH4 emission avoided Number of rice paddy fields with	2024	2030	Reports, site inspections

		limited technology	financing strategies			improved post-harvest practices			

6.4 Energy and Transport Sectors

Overall Methane Reduction Goal/Target	To reduce methane emissions from the Energy and Transport Sectors from 0.01123 MtCO2e to 0.00669 MtCO2e below BAU level by 2030 (a reduction of 0.00454 MtCO2e)								
Actions	**Responsible Institutions**	**Barriers**	**Means of overcoming the barriers**	**Regulatory instruments**	**Means of Finance**	**Indicator**	**Implementation time/schedule**		**Means of Verification**
							Start	**End**	
Action 1: Implement enforcement mechanisms at Liberia's 76 ports of entry including the Freeport of Monrovia by increasing the tax on vehicles older than 10 years	MoT, EPA, MFDP, LRA, MOC	Political interference Low vehicle purchasing power Conflict of interest The current data collection and management system at MOT needs to be upgraded Poor availability and	Inclusive and supportive government policies and regulations Improve monitoring of vehicle tax collection activities and other data Introduce an electronic payment system (digitize the system)	NDC, EPA Act, the ARREST Agenda, MOT policies and regulations	National funding, donor funding	Number of vehicles prevented from entering because of non-compliance Number of motor vehicle data collection system upgraded Number of vehicles older than 10 years charged higher taxes Reduction in the number of	2025	2030	Inspection records Vehicle registration reports

		management of data Public acceptance, Financial constraints				older vehicles imported			
Action 2: Encourage the importation of Electric Vehicles by adopting public procurement policies that prioritize the purchase of electric, solar, and biofuel-fueled vehicles for government entities (Government can lead by example; stimulate demand for alternative fuel vehicles and help expand the market for clean transportation)	MOT, RREA. MME, NTA, Commerce, LRA, LEC, Office of the President, Private Sector	The initial prices are high ($3,000-3,500 for fuel combustion tricycles compared to $5,000 for Electric Tricycles) Low awareness on the value of EVs Limited charging facilities	Provide subsidies and incentives for EV sector Access climate funds to stimulate the EV sector Increase public awareness on the value of EVs	Executive Order 134, NDC, EPA Act, the ARREST Agenda	National and donor funding	Number of EVs imported per year from 2025-2030 (prioritizing tricycles – target 600 tricycles and 100 cars) Number of charging stations are needed to service 600 EVs (3 hours to charge)	2025	2030	MOC and NPA reports on vehicle imports

Action 3: Develop EV policy to sustain investment in EVs and guide the use of EVs (where they can move, how much they can be taxed, and the incentives for EV owners)	MOT, MME, RREA, EPA, LRA, MFDP	Government bureaucracy may slow the process down	Engage the office of the President to fast-track the process	Executive Order 134	National and donor funding	Number of policies passed into law (target one)	2025	2029	Policy passed into law
Action 4: Encourage the importation of cleaner fuel options such as low-sulfur diesel and biofuels.	MoT, MME, EPA	Financial constraints, Limited access to technology	Inclusive and supportive government policies and regulations	NDC, EPA Act, the ARREST Agenda, LPRC Act	National Funding	Number of fuel stations offering low-sulfur diesel and biofuels Number of gallons of low-sulfur diesel and biofuels imported or manufactured in Liberia per year	2024	2027	Surveys of fuel stations, NPA and MOT reports on imports, reports from private sector groups manufacturing biofuels
Action 5: Explore opportunities for integrating renewable energy sources,	MME, LEC, LERC, EPA	Financial constraints, Limited access to technology	Inclusive and supportive government policies and regulations	NDC, EPA act, the ARREST Agenda	National Funding	Number of renewable energy projects completed	2025	2027	Project completion reports

such as solar, wind, and hydroelectric power, into LEC expansion plans									
Action 6: Allocate funds for the expansion of electricity infrastructure, including transmission lines, substations, and distribution networks, to connect additional municipalities to the LEC grid.	MME, MFDP, LEC, LERC, EPA	Political acceptance Financial constraints	Inclusive and supportive government policies and regulations	NDC, EPA act, the ARREST Agenda	National Funding	Amount of funds allocated for LEC expansion	2025	2030	National Budget 2005-2030
Action 7: Develop separate emissions factors for the energy and transport sectors	MOT, MME, and EPA	Financial constraints Inadequate technical capacity	Set up a program through which MOT, MFDP, MME, and EPA can contribute funds for this activity	NDC, EPA Act, Methane Roadmap	National and donor funding	Number of emissions factors for the Energy and Transport sectors (target two)	2025	2029	2 emissions factors policy briefs on the new emissions factors for the Energy and

									Transport sectors
Action 8: Upgrade 1 motor vehicle data management system	MOT, EPA, MME, MFDP, LRA	Financial constraints, political will	Set up a program through which MOT, MFDP, MME, and EPA can contribute funds	MOT Act	National and donor funding	Number of upgraded motor vehicle date management systems (target one)	2025	2028	An upgraded and functional motor vehicle manageme nt system
Action 9: Set emissions standards and guidelines for vehicles and fuel grade	MOT, LPRC, EPA	Financial constraints, political will	Set up a program through which MOT, MFDP, MME, and EPA can contribute funds	MOT Regulation	National and donor funding	Number of regulations (target one)	2025	2026	An approved regulation on all levels
Action 10: Expand grid electrification to 5 counties working with LEC and other private companies	MME, LEC, Jungle Power (JEP), LIB Energy, Totota Electricity Corporation (TEC)	Financial constraints	MME should source the funding	LEC and MME Acts	National and donor funding	Number of new counties on the national grid (target five)	2025	2027	Five (5) new counties on the national grid

Action 11: Through the St. Paul 2 project (World Bank), Bong, Margibi, Montserrado, Bomi, Cape Mount, and Gbarpolu will be electrified on the LEC grid which is hydroelectric	MME, LEC	Financial constraints	MME should source the funding	LEC and MME Acts	National and donor funding	Number of new counties electrified through World Bank. Project (target six)	2025	2030	Six (6) new counties electrified through World Bank. project
Action 12: Expand renewable energy access in 5 districts in Lofa County	RREA	Financial constraints	RREA should source the funding	RREA Act	National and donor funding	Number of new districts in Lofa with access to renewable energy (target five)	2025	2030	Five (5) new districts in Lofa County with access to renewable energy
Action 13: Expand hydro power in parts of Nimba, Bong, River Gee, and Maryland Counties	MME, LEC, RREA, EPA	Financial constraints	RREA should source the funding	RREA Act	National and donor funding	Number of new counties have hydro power (target four)	2025	2030	Four (4) new counties have hydro power

Action 14: Electrify 90 public health facilities through stand-alone solar systems across the country from 2021-2026	RREA, LEC, MME, EPA	Financial constraints	RREA should source the funding	RREA Act	National and donor funding	Number of public health facilities electrified across Liberia	2025	2027	Ninety (90) public health facilities electrified across Liberia

7.0 Operationalizing the Methane Roadmap

The EPA will operationalize the M-RAP by hosting regular meetings with key stakeholders particularly MFDP, MCC, PCC, MOT, MOA, MME, and RREA. These meetings should involve the costing of the M-RAP actions in section 6.0 of this document, the development of a resource mobilization plan, and drafting of proposals to apply for funding from the government and donors. More awareness raising on the M-RAP should be done with donors and partners in order to mainstream the M-RAP in their different plans, programs, and projects.

1. ***2025 Priorities***
    a. Resource mobilization
    b. Focus on improving data collection and management in the four sectors
    c. Map and monitor actions that are already being funded
2. ***2026 Priorities***
    a. Resource mobilization
    b. Implement M-RAP actions that are considered 'Low hanging fruits" in the four sectors such as assessments, policy review, creation and formalization
    c. Monitor actions that are already being funded
3. ***2027 Priorities***
    a. Resource mobilization
    b. Implement infrastructure projects in the waste and energy sectors
    c. Conduct mid-term evaluation of M-RAP implementation
    d. Monitor actions that are already being funded
4. ***2028 Priorities***
    a. Resources mobilization
    b. Focus on the importation of EVs and other clean energy products
    c. Monitor actions that are already being funded
5. ***2029 Priorities***
    a. Resource mobilization
    b. Assess data collection and management program in the four sectors
    c. Focus on the implementation of actions in the agriculture sector
    d. Monitor actions that are already being funded
6. **2030 Priorities**
    a. Resource mobilization
    b. Monitor actions that are already being funded
    c. Conduct evaluation of M-RAP implementation

Annex 1: M&E Plan

There will be a midterm review after 3 years based on the availability of data.

Waste Sector

The waste sector has sixteen (16) Actions in the Methane Roadmap. Each Action represents an Indicator. Hence, there are 16 indicators for the waste sector. Below is an example of the M&E plan for the Waste Sector: Action/Indicator 1.

Indicator name	**Action 1**: Conduct comprehensive assessments to identify suitable locations for landfill sites, considering factors such as proximity to population centers, geological suitability, and environmental impact		
Definition of indicator	This indicator measures the number of assessments done to identify suitable locations for landfill sites		
Disaggregation			
Unit of measurement	Number		
Level of measurement	Output		
Data Source	Assessment Reports, Activity Reports		
Data Acquisition Method	Review of reports		
Frequency	Annually		
Responsibility	MCC, PCC, EPA		
Baseline	To be determined based on initial assessment		
Target Note	The goal is to establish 3 landfill sites within Montserrado and Margibi Counties.		
Year	**Target**	**Actual**	**Observations**

FY2025	1	N/A	N/A
FY2026	1	N/A	N/A
FY2027	1	N/A	N/A
FY2028		N/A	N/A
FY2029		N/A	N/A
FY2030		N/A	N/A
Total Target	3	N/A	N/A

Agriculture Sector

The Agriculture sector has eleven (11) Actions in the Methane Roadmap. Each Action represents an Indicator. Hence, there are 11 indicators for the Agriculture sector. Below is an example of the M&E plan for the Agriculture Sector: Action/Indicator 1.

Indicator name	**Action 1**. Promote Alternate Wetting and Drying (AWD) in at least 30% of 50,000 hectares of irrigated rice paddy fields
Definition of indicator	This indicator measures the percentage of the 50,000 hectares of irrigated rice paddy farms that will use AWD.
Disaggregation	
Unit of measurement	Number
Level of measurement	Output
Data Source	Activity Reports
Data Acquisition Method	Review of reports
Frequency	Annually

Responsibility	MOA, EPA		
Baseline	To be determined based on initial assessment		
Target Note	According to the National Agriculture Development Plan, 50,000 hectares will be irrigated for rice paddy fields from 2024 to 2030. The objective of the Methane Roadmap is the ensure that 30% of the 50,000 hectares are using AWD		
Year	**Target**	**Actual**	**Observations**
FY2025		N/A	N/A
FY2026	5%	N/A	N/A
FY2027	5%	N/A	N/A
FY2028	10%	N/A	N/A
FY2029	10%	N/A	N/A
FY2030		N/A	N/A
Total Target	30%	N/A	N/A

Energy/Transport Sectors

The Energy/Transport sector has fourteen (14) Actions in the Methane Roadmap. Each Action represents an Indicator. Hence, there are 14 indicators for the Energy/Transport sector. Below is an example of the M&E plan for the Energy/Transport: Action/Indicator 1.

Indicator name	**Action 1**: Implement enforcement mechanisms at Liberia's 76 ports of entry including the Freeport of Monrovia by increasing the tax on vehicles older than 10 years.

Definition of indicator	This indicator measures the number of vehicles prevented from entering because of non-compliance, number of motor vehicle data collection systems upgraded, and number of vehicles older than 10 years charged higher taxes		
Disaggregation			
Unit of measurement	Number		
Level of measurement	Output		
Data Source	Inspection records and vehicle registration report		
Data Acquisition Method	Review of reports		
Frequency	Annually		
Responsibility	MOT, MME, EPA		
Baseline	To be determined based on initial assessment		
Target Note	The goal is to upgrade the motor vehicle data collection system, and prevent cars older than 10 years from entering Liberia through increased taxes and duties that will discourage their importation		
Year	**Target**	**Actual**	**Observations**
FY2025		N/A	N/A
FY2026	1 system upgraded; number of vehicles prevented from entering are to be determined based on the upgrade of the system	N/A	N/A
FY2027	Number of vehicles prevented from entering	N/A	N/A

	are to be determined based on the upgrade of the system		
FY2028	Number of vehicles prevented from entering are to be determined based on the upgrade of the system	N/A	N/A
FY2029	Number of vehicles prevented from entering are to be determined based on the upgrade of the system	N/A	N/A
FY2030	Number of vehicles prevented from entering are to be determined based on the upgrade of the system	N/A	N/A
Total Target	TBD	N/A	N/A

*Note: There are forty-one (41) Actions/Indicators in the Methane Roadmap M&E Plan. When implementing the Methane Roadmap, a similar plan will be developed for each Action/Indicator.

Annex 3: Communications Strategy for the M-RAP

Communications Matrix for the Waste Sector

Target Audience	Communication messages	Communication Channels	Communications Products
MCC/PCC/Others	• EPA should recognize city corporations and private sectors as key stakeholders in the management of waste and mitigation of methane emissions.	• Regular stakeholder engagement with city corporations and private sectors to secure support. • invitations to CBEs, city corporations, communities, Ministry of Finance, and funding partners/donors. • Electronic and print media, community radios in different languages, social media (Facebook)	• Radio talk shows and jingles • Visual aids: Posters, newsletters, and videos.
General Public/Households	• Education of waste management; types of waste, quantities of waste generated, collection of waste, and disposal of waste. • Awareness of GHG emissions from improper waste management	• Electronic and print media, community radios using different languages, and social media (Facebook).	• Pre-recorded drama, videos, talk shows, jingles on waste management. • Visual aids: Posters, and videos.

	and impacts on the global and national environment. • Education on Waste separation practices should include (plastic, paper, cloth, things that get rotten (food), iron, glass, electronics). • Awareness of organic waste products and uses; separation of organic waste for composting makes your soil rich and fertile for farming and gardening. • Improper disposal of waste like plastic in the ocean or river affects marine ecosystems and their services		
Community-Based Enterprises	• Awareness of waste opportunities in waste management in the private sector. • Education on waste-to-wealth concept for private sector engagement • Awareness of enabling environment and provision of incentives for the private sector to engage in waste management	• Conduct seminars/workshops for communities and private sectors to learn more about waste management opportunities and strategies.	• Visual aids: Posters, and videos. • Jingles.
Community Leaders	• Strengthen bylaws to manage waste in the community. • Awareness of leadership participation in community waste	• Community forums, focus group discussions and key informant engagement.	• Visual aids: Posters, and videos. • jingles

	management to encourage communities to take action.		

Communications Matrix for the Energy Sector

Target Audience	Key Messages	Communication Channels	Communications Products
Ministry of Mines and Energy (MME), Liberia Petroleum Refinery Company (LPRC)	• Awareness of methane emission from the energy sector; emission from energy activities and storage, impact of private energy generation, importance of clean energy generation and expansion. • Encourage renewable energy partnerships and usage businesses in Liberia.	• Stakeholder engagement to garner political buy-in for methane reduction in the energy sector. • Invite MME, Ministry of Finance, other relevant ministries, private sector, and funding partners/donors support. • Electronic and print media, community radios using different languages, social media (Facebook)	• Radio talk shows, and jingles. • Visual aids: Posters, and videos
Petroleum Importers	• Awareness of methane emission from the energy sector; emission from energy activities and storage, impact of private energy generation, importance of clean energy generation and expansion.	• Electronic and print media, community radios using different languages, social media • Stakeholder engagement to garner political buy-in for methane reduction in the energy sector.	• radio drama, talk shows, jingles visual aids, videos, and talk shows on methane emission. • Visual aids: Posters, and videos.

	• Encourage renewable energy partnerships and usage businesses in Liberia.	• Invite MME, Ministry of Finance, other relevant ministries, private sector, and funding partners/donors support.	

Communications Matrix for the Energy and Transport Sectors

Target Audience	Key Messages	Communication Channels	Communications Products
Ministry of Transport/LPRC/NPA	• Awareness of methane emission from the transport sector. • Provision of incentives/tax breaks for businesses that bring in brand-new and fuel-efficient cars. • Encourage the use of electric vehicles through the provision of incentives for the importation of electric vehicles	• Stakeholder engagement to get political and private sector participation; Invite MME, Ministry of Finance, other relevant ministries, the private sector, and funding partners/donors. • Electronic and print media, community radios using different languages, social media (Facebook)	• Radio talk shows and jingles. • Visual aids: Posters, and videos.

General Public/Car owners	• Provide awareness and implementation of tax penalties on the importation of energy-inefficient vehicles. • Encourage the use of buses and bicycles to reduce methane emissions from high-fuel combustion activities. • Encourage and create awareness on the practice and importance of safe car-pooling activities.	• Electronic and print media, community radios using different languages, social media (Facebook)	• Radio drama, jingles, videos, and talk shows on methane emissions. • Visual aids: Posters, and videos.

Communications Matrix for the Agriculture Sector

Target Audience	Key Messages	Communication Channels	Communications Products
Ministry of Agriculture, Smallholder farmers, Farmer corporations.	• Raise awareness on agriculture practices in the rice sector (paddy rice production) • Create awareness of waste disposal in the agricultural sector	Electronic and print media, community radios using different languages, social media (Facebook)	• Radio talk shows, and jingles. • Visual aids: Posters, and videos
General public	• Promote best practices in livestock farming	Electronic and print media, community radios using different languages, social media (Facebook)	• Radio talk shows, and jingles. • Visual aids: Posters, and videos

Annex 4: Training Manual

Methane Technical Working Group Training Manual

Guide to Support the Development and Implementation of Liberia's National Methane Roadmap

Introduction

Methane, classified as a short-lived climate pollutant (SLCP), is a significant contributor to the current global warming crisis. Its potency is evidenced by its contribution to roughly half of the recent surge in global average temperatures. Addressing and curbing human-caused methane emissions emerges as a pivotal and cost-effective strategy to decelerate global warming, aligning with the global temperature target of 1.5°C. A Global Methane Assessment (GMA) was adopted to curb methane emissions to achieve the Paris Agreement's 1.5°C target economically. A 30-60% reduction target has been set by 2030 compared to 2020 levels. This action necessitates a significant mitigation effort across major methane-emitting sectors.

Liberia has exhibited it commitment to the Global Methane reduction target by carrying out the following; adopting the Global Methane Pledge and in the process of developing a Methane Roadmap Action Program (M-RAP) aimed at reducing methane emissions in the major emitting sectors such as agriculture, energy/transportation, and waste. In August 2023, the CCAC and UNEP in collaboration with the government of Liberia (EPA) awarded GREENLIFE West Africa a one-year contract to develop Liberia's M-RAP and fortify the capabilities of national stakeholders and key industries to realize this roadmap.

As part of the national stakeholders and expert consultation, a national Methane Technical Working Group (MTWG) was established made up of national experts from various MACs, private sectors, and NGOs. The roles and responsibilities of the MTWG is to integrate the M-RAP outcomes into the sectoral/national activities and plans, including data collection and management on methane emissions in Liberia for reporting and verification purposes. In the first quarter of the roadmap development, two MTWG workshops; a learning workshop and a training workshop, were organized for the methane working group. The purpose of the workshops was to provide MTWG members an opportunity to validate essential documents, discuss a data-sharing agreement/protocol between the project's partners, and discuss the various institutional MOUs between the participating agencies with the EPA.

The development of a training manual was established during the institutional stakeholders learning and training engagements to strengthen the capacities and knowledge of the MTWG members on methane emission reduction and management in Liberia and for the various sub-sectors. The roles and responsibilities of the MTWG are well defined in its operational manual. The cardinal responsibility of the MTWG sub-groups is to source, retrieve, and share data concerning their respective sectors with the M-RAP consultants.

This comprehensive training manual will equip members of the Methane Technical Working Group (MTWG) with the knowledge and skills necessary to tackle methane emissions reduction in the country. It also caters to the specific needs of each sub-working group within the context of Liberia's agricultural, waste, energy/transport sectors, including cross-cutting areas.
Through a combination of theoretical insights and practical exercises, the MTWG members will gain expertise in:

- Understanding the science of methane and its impact on climate change.
- Identifying and quantifying methane emissions in Liberia's key sectors.
- Implementing effective mitigation strategies for each sector.
- Collaborating across sectors to achieve national methane reduction targets.

This manual is structured to cater to the specific needs of each MTWG sub-working groups:

- Agricultural Sub-sector: Delving into enteric fermentation, manure management, rice cultivation emissions, and sector-specific mitigation strategies. Implementing best practices in livestock management, rice cultivation, and organic waste management can significantly reduce methane emissions. Techniques such as feed optimization, anaerobic digestion, and alternative wetting and drying in rice fields are highlighted.
- Waste Sub-sector: Exploring municipal landfills, wastewater treatment, organic waste composting, biogas capture and utilization, and tailored mitigation options. Effective landfill management and waste-to-energy technologies are key in reducing methane emissions from waste. Capturing methane for energy production not only mitigates emissions but also contributes to renewable energy sources.
- Energy/Transport Sub-sector: Focusing on gas infrastructure leakage, vehicle and fuel emissions, and the potential for renewable energy alternatives. Reducing methane emissions in the energy sector focuses on improving efficiency in fossil fuel extraction and promoting renewable energy alternatives. In transportation, transitioning to lower-emission vehicles and fuels plays a crucial role.
- Cross-Cutting Sub-sector: Integrating knowledge across sectors, understanding data collection and management systems, and navigating Liberia's policy and legal frameworks for methane mitigation.

Training Modules

Module 1: Understanding Methane Emissions and the M-RAP Framework (All Sub-sectors)	
The Science of Methane	Dive into the greenhouse effect, methane's role in climate change, and its sources within Liberia's context. Examples: • What is methane? • Sources of methane emissions • Climate impacts of methane • Importance of methane mitigation
The Global Methane Pledge and Liberia's NDCs	Explore the international commitment to methane reduction and Liberia's specific targets outlined in its Revised Nationally Determined Contributions.
Liberia's M-RAP Framework:	Understand the national Measurement, Reporting, and Verification framework adopted for methane emissions, including key methodologies and reporting requirements.
Module 2: Sector-Specific Methane Management	
Agricultural Sub-sector	
Enteric fermentation	Analyze emission sources, explore dietary and management strategies for reducing emissions, and discuss advanced technologies like methane inhibitors for cattle rearing.
Manure management	Understand the role manure plays in methane production, explore storage and treatment options like anaerobic digestion, and learn about biogas utilization for energy generation.

Rice cultivation emissions	Learn about methane emissions from rice paddies and explore mitigation strategies like alternate wetting and drying (AWD) and water-efficient rice varieties.
Waste Sub-sector	
Landfills	Explore landfill gas capture and utilization technologies, learn about waste segregation and composting initiatives, and discuss advanced landfill management practices.
Wastewater treatment	Understand the methane generation potential in wastewater treatment plants, explore anaerobic treatment technologies, and discuss resource recovery options like biogas production.
Organic waste composting	Analyze the benefits of composting for methane reduction, learn about composting techniques and infrastructure requirements, and discuss the potential for biofertilizer production.
Energy/Transport Sub-sector	
Vehicle and fuel emissions	Understand the role of transportation in methane emissions and explore mitigation strategies like fuel switching, vehicle electrification, and improved engine efficiency.
Renewable energy alternatives	Explore the potential of renewable energy sources like solar, wind, and hydropower to replace fossil fuels in the energy mix and contribute to methane reduction.
Gas infrastructure leakage	Understand the sources and detection methods for gas leaks at storage facilities, explore storage maintenance strategies, and discuss best practices for leak prevention and repair.
Cross-Cutting Sub-sector	

Integration across sectors	Explore the interconnectedness of methane emissions across sectors and identify opportunities for cross-sectoral collaboration and mitigation strategies.
Data collection and management	Explore data collection methodologies and tools for different emission sources, explore data analysis and reporting procedures, and discuss data sharing and management platforms.
Policy and legal frameworks:	Explore Liberia's existing policies and legal frameworks relevant to methane mitigation, explore potential policy interventions, and discuss the role of advocacy in strengthening the legal landscape.
Module 3: Measurement and Monitoring Techniques (All Sectors)	
Inventory Methodologies	Learn about different Tier levels for methane emission inventories and their application in Liberia's context.
Field Measurement Equipment	Gain hands-on experience with various instruments used for measuring methane emissions, including portable analyzers, chambers, and flux towers.
Data collection protocols	Understand proper data collection procedures for different methane sources and sectors, including sampling techniques, quality assurance/quality control (QA/QC) measures, and data recording methods.
Data Analysis, Reporting, and Verification	Understand data analysis techniques, explore reporting formats and procedures for M-RAP compliance, and learn about verification processes for ensuring data quality.
Module 4: Mitigating Methane Emissions and Action Planning (All Sectors)	
Existing and Potential Mitigation Strategies	Analyze and compare various mitigation options for each sector, including their costs, benefits, and technical feasibility in the Liberian context.

Develop sector-specific action plans	Each sub-working group will develop an action plan outlining specific mitigation strategies, timelines, responsible institutions, and resource requirements for their sector.

Training Methodology

To significantly improve MTWG members' skills and knowledge, making them more effective in their roles, the training methodology will introduce two key learning approaches.

Interactive Learning Approaches

Interactive learning approaches engage participants actively in the learning process, making the training more effective and memorable. Methods such as group discussions encourage sharing of ideas and experiences, enriching the learning environment. Role-playing and simulations can be particularly effective in methane management training, allowing participants to practice negotiation, problem-solving, and decision-making skills in a controlled, risk-free environment. Incorporating interactive tools like real-time polls and quizzes during presentations can also help in assessing understanding and retaining interest.

This segment will involve:

Group Discussions: Engage in thought-provoking discussions on methane reduction strategies and share your experiences and ideas with peers.

Role-Playing Sessions: Participate in simulated scenarios that mimic real-life challenges in methane management, allowing you to practice decision-making and problem-solving skills.

Real-Time Polls and Quizzes: Test your knowledge and stay engaged with instant feedback during presentations through interactive polls and quizzes.

The goal is to create a dynamic learning environment that fosters collaboration, critical thinking, and a deeper understanding of methane management practices.

Hands-On Training

Hands-on training involves practical exercises that allow participants to directly apply their knowledge in real-world scenarios. For methane management, this could include field visits to agricultural sites, landfills, or energy facilities to observe and participate in methane measurement and mitigation practices.

Workshops where participants can use measurement instruments, analyze data, and simulate mitigation strategies provide valuable practical experience. This approach not only enhances technical skills but also helps in understanding the complexities and challenges of methane management in different sectors.

This segment includes:

Field Visits: Experience firsthand the implementation of methane mitigation strategies at local agricultural sites, landfills, and energy facilities. Observe, ask questions, and gain insights from on-ground experts.

Practical Workshops: Get direct experience with methane measurement instruments and data analysis tools. Participate in workshops designed to simulate real-world methane mitigation planning and execution.

This practical exposure is designed to equip learners with the skills and confidence needed to tackle methane management challenges effectively.

Annex 5: Data Management Protocol for Liberia M-RAP

I. Introduction

A robust data management protocol is critical for ensuring data reliability and validity during the preparation and implementation of the Methane Road Map and Action Plan (M-RAP). It ensures interagency coordination, collaboration and decision-making concerning methane mitigation and related policies and measures. In this section of the M-RAP, the strategies and procedures for collecting, sharing, and managing information on Methane emissions and reduction are described in the context of Liberia's circumstances. Furthermore, data management procedures for reporting and presentation by the relevant Methane emission-intensive sectors are discussed.

II. Description of the Protocol M-RAP Preparation

One of the main outputs of the M-RAP is the establishment of a sector-based Methane Technical Working Group (MTWG). The roles and responsibilities of the MTWG are well defined in its operational manual. The cardinal responsibility of the sub-groups is to source, retrieve, and share data concerning their respective sectors with the M-RAP consultants. For example, the Agriculture MTWG will source and retrieve data on existing relevant methane policies, projects, and programs. If available, the data should include inventory reports and baseline assessments/surveys. Such data can be collected from institutional repositories, personal computers, websites, and other sources. The data will be analyzed and used by the consultants to inform the preparation of the M-RAP. The sub-technical groups will be responsible for participating in the analysis to strengthen their capacities. They will join in capacity-building training and validation of reports.

III. Description of the protocol M-RAP Implementation

The Methane RoadMap and Action Plan (M-RAP), data management protocol was prepared with the objective that it will be used as an instrument to foster collaboration towards reducing Liberia’s Methane footprint in line with its commitment to the Global Methane Pledge (GMP). The procedure assumes sturdy interagency coordination among the pertinent government and private sector stakeholders to ease data collection, analysis and sharing, at all levels. It describes data management at the National and County levels within the framework of preparing the M-RAP and its subsequent implementation.

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Currently, an information-sharing framework exists that includes the methane emission sectors. This framework allows the public, private, and NGO sector to share their data or reports with the Environmental Protection Agency of Liberia (EPA). The EPA is the statutory body established under the Act creating the Environmental Protection Agency (EPA) in 2002. This mechanism allows development partners implementing or having a stake in the M-RAP to collect, collate, and share national and county-level data with the EPA of Liberia. It ensures the effective and efficient use of staff given that most Government entities have limited staff in the field, especially at levels below the County (i.e., district, clan, etc.)

IV. County-level Procedure

At the county level, for each of the Methane emission-intensive sectors, the M-RAP Focal Person, in consultation with M&E and data officers at the county level, will track data on methane emissions and the implementation of M-RAP.

Stakeholders and development partners participating in development efforts in the county share information/data relevant to their respective areas of operation with the government county offices for onward submission to the central office at the national level. As such, development partners implementing M-RAP-related programs and projects at the county level will be expected to share data/reports with the County Office.

The County reports will then be transmitted to their respective national offices for consolidation and reporting. It is essential for the variety of actors responsible for reporting to have templates for M&E-related activities and Methane emission reduction tracking tools with transparent accountability systems for regular reporting. The EPA can facilitate this since it is the nationally designated entity responsible for overall Greenhouse Gas emissions management in Liberia.

V. National Level

Most counties need more technical capacity to do a vigorous data analysis. As such, senior data analysts should collate and analyze data from the counties nationally. The analysis should include data collected by the focal persons of each sectoral entity at the national level. The requisite divisions or unit focal persons under each of the Methane sectors will submit reports to their respective corresponding departments to be included in the entity's progress reports, with copies to the Methane Focal Person at the EPA and GREENLIFE, Liberia Consultants. Inputs will be communicated to the concerned counties and decision-makers to inform decision-making at these levels.

Cognizant that data reporting can become irregular and poorly quality when findings are not used at the collection level (county/national). Implementing entities must exert every effort to equip data collectors with the capacity to collect and utilise reports and feedback at the operational level. This will be possible when staff forms part of formulating the annual work plans and budgets embedded with relevant M-RAP activities to inform set indicators. This justifies quarterly progress review meetings by each sector's stakeholders. In other words, quarterly progress review meetings should be held at the national and county levels to allow for feedback from participants at this level. This can be achieved if progress reviews are held at all levels, enabling stakeholders to participate and provide input.

For this reason, the Methane Technical Working Group (MTWG), consisting of technicians from the different MACs and the private sector, was established to implement provisions of the Protocol. The body should include public, private, and NGO technicians responsible for Liberia's methane emissions. For example, the Ministry of Agriculture (MOA), Municipal Authorities, and Waste Management Small and Medium Enterprises (SMEs). The designated Nationally Determined Contributions (NDC) focal persons at each institution should also be members of the MTWG. The individuals should have the skills and an in-depth understanding of their roles in collecting and reporting requisite information. This will ensure that the data collected is of high quality and relevant to achieving the objective of the M-RAP.

To enhance monitoring and reporting, institutions of each M-RAP sector are encouraged to use their existing M&E or MRV system where applicable. However, technical and financial support will be necessary to strengthen the functionality and interoperability of these systems. The EPA is

responsible for the centralized role of coordinating, collecting, and reporting on the object of the M-RAP. It is, therefore, the repository of M-RAP documents, including M&E and MRV Reports.

Findings from MRV activities should be used to make managerial decisions at each level of the M-RAP implementation. In addition to the direct use by the levels of collecting the data, stakeholders should give feedback regarding the results of the data collected and the analysis made at higher levels. This recognizes participation in the process and builds ownership, given that their views are usually incorporated to improve implementation performance.

During quarterly progress review meetings, only performance data should be presented based on "where were we" (baseline), "where do we want to go" (planned), and "where we are now" (actual) per indicator. To establish context, minimum background information could be provided. Findings and recommendations should be formulated as close as possible to critical outcomes. A separate report with detailed data can be presented in an annex/appendix. The table below presents key points of analysis and questions to be considered during the presentation of progress reports of the M-RAP.

Table 1: Data analysis procedures for reporting and data presentation

Focus of Analysis	Technique of Analysis	Questions to be Answered
Description of program performance	• Compare actual performance against targets • Compare current performance to baseline • Analyze trends in performance • Comparison between sites and groups	• Is the M-RAP implementation on track? • Did we meet our target? Why and why not? • How does this period's performance compare to the last period? • What happened that we did not expect? Did it lead to any positive or negative unintended consequences? • Are our new interim targets needed, or do we need to review the target? • Are we reaching all the required target groups and sites adequately? • What are the program's weaknesses; do they need to be improved or phased out? • What are we doing right? Can we do more of this and apply this strategy to other areas? • Do we need additional funding or expansion of the program? • How can we apply lessons learned to improve outcomes across the M-RAP implementation? • Is there sufficient coordination across sectors to ensure efficient and effective M-RAP implementation?

i. Sources of Data

M-RAP sectors will serve as data sources during the preparation and implementation of the M-RAP. Hence, data will be collected from more than one group of actors. This makes it possible to compare data from various sources and check their reliability. These sources will include but are not limited to the statistical units of implementing entities and the various reports (i.e., annual and quarterly reports, commissioned studies, etc.)

ii. Information/Data Sharing and Management

A vigorous communication strategy is crucial for disseminating information, sharing it with key stakeholders, and gathering information from stakeholders to inform more effective implementation strategies. Consistent and transparent information exchange about the M-RAP implementation will generate more buy-in across Liberia and opportunities for scaling up and -out best practices learned. It is essential that the Environment Protection Agency regularly shares updated information about M-RAP implementation widely and that all actors across Liberian society have opportunities to share information with the Government of Liberia about their experiences with M-RAP implementation.

Results-based information should be shared with all internal and external stakeholders with the opportunity to react, give feedback, and make inputs. Each entity implementing the M-RAP is to produce quarterly and annual reports and share them with the EPA for compilation and dissemination upon the approval of the EPA. Apart from disseminating reports, other specific strategies should be adopted under the M-RAP for sharing information, including using digital platforms such as the Environmental Knowledge Management System (EKMS), the websites of the sectoral institutions. Additionally, progress reports and critical data about the M-RAP implementation and opportunities for information exchange can be disseminated widely via traditional media and social media platforms (Twitter, Facebook, etc.). Feedback sessions, such as town hall meetings, should be planned regularly – nationally, regionally, and in local/rural areas for the GoL to share information, listen to the experiences of various actors across Liberian society, and gather ideas for continuous improvement of the M-RAP implementation, as well as allow for stock-taking of Liberia's performance of agreed targets in the M-RAP. Civil Society Organizations could play a crucial role in the town hall meetings to create a feedback loop for stakeholders, especially at the local level.