Sierra Leone's First Biennial Update Report

Government of Sierra Leone's Submission to UNFCCC - 2021

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This report was compiled by the Climate Change Secretariat of the Environmental Protection Agency (EPA), under the supervision of the Ministry of the Environment and Climate Change (MoECC). The report is prepared to meet Sierra Leone's obligation to the United Nations Framework Convention on Climate Change (UNFCCC) as non-Annex I Parties by submitting a Biennial Update Report (BUR) on the status of its GHG emissions and removals by sinks, as well as on the actions to reduce emissions or enhance sinks in Sierra Leone. Our inability to submit the BUR on time was due to delays in securing the requisite funds to support the preparation ahead of time, the technical capacity at local level to support the process, and the global pandemic (COVID19).

The BUR has been prepared as per the UNFCCC Biennial Update Report guidelines for Parties not included in Annex 1 to the Convention.

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Foreword

I am proud to present the Sierra Leone Initial Biennial Update Report (BUR) to the United Nations Framework Convention on Climate Change (UNFCCC) as our commitment to the Convention. BUR is an opportunity to showcase the country's initiatives and actions towards low carbon growth, poverty alleviation, and sustainable development. Sierra Leone is moving gradually on all three fronts. Action towards climate change is a common concern for humanity, and it is our ethical and moral responsibility to address it by using all means at our disposal. Under the dynamic leadership of His Excellence, the President of the Republic of Sierra Leone, Rtd Brigadier, Dr. Julius Maada Bio, is taking several proactive actions at the national level to fulfil its obligations as per the principle of common but differentiated responsibilities and respective capabilities.

Upon adoption of the Paris Agreement, Sierra Leone ratified the Paris Agreement in June 2016 and submitted its first Nationally Determined Contribution in 2015. Sierra Leone continues her efforts and actions as a Non-Annex 1 party to the United Nations Framework Convention on Climate Change (UNFCCC) through several policies, measures, and actions to implement a comprehensive national response to climate change while ensuring national development in a sustainable manner.

In accordance Non-Annex 1 parties, conference of parties (COP) 17 decision (decision 2/CP 17) para 41. Consistent with the capacities and the level of support provided for their reporting, Sierra Leone should submit its first Biennial Update Report. To fulfil this, Sierra Leone has prepared its first Biennial Update Report, ready to be submitted and recorded by the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC). This will be followed by the submission of the fourth national communication upon completion in 2024.

Sierra Leone is committed to taking climate action in a manner that takes care of the vulnerabilities of its people while ensuring basic amenities and a life of dignity for all. In the process, the government has received enthusiastic support from ordinary people, academia, businesses, and media, amongst others, thus making the entire process inclusive and participatory.

I congratulate all those involved in the preparation of Sierra Leone's Initial BUR

Acronyms

AA	Administrative Assistant
AFOLU	Agriculture Forestry and Land Use
BUR	Biennial Update Report
CCS	Climate Change Secretariat
CCSAP	Climate Change Strategy and Action Plan
CSSL	Conservation Society, Sierra Leone
EF	Emission Factor
ECOWAS	Economic Community of West African State
IPPU	Industrial Processes and Product Use
MAFFS	Ministry of Agriculture and Food Security
MoEnv	Ministry of the Environment
MOE	Ministry of Energy
MASSADA	A Waste Management Company in Freetown
MBSE	Ministry of Basic and Secondary Education
MRU	Mano River Union
NC	National Communication
MTA	Ministry of Transport and Aviation
MTNDP	Medium-Term National Development Plan
NCCS	National Climate Change Secretariat
ND	"New Direction" (Sierra Leone National Development Plan 2019/24)
NDC	Nationally Determined Contribution
NPPA	National Protected Area Authority
PA	Paris Agreement
SLS	Sierra Leone Statistics
SLSB	Sierra Leone Standard Bureau
UNFCCC	United Nations Framework Convention on Climate Change
WONES	A women's Empowerment Association

Contents

Tables

Figures

Executive Summary

RE0: BIENNIAL UPDATE REPORT 1

The content of this Biennial Update Report (BUR1) is an update of the different chapters of the Third National Communications (TNC) of 2017. One of the major parts of this BUR1 is the updated greenhouse gas inventory, which reports on the updates in methodology and other improvements that happened after the last inventory presented in the TNC.

RE1: NATIONAL CIRCUMSTANCES

Sierra Leone is located in the northern-western part of West Africa and lies between latitudes 7(6 degrees 55 minutes) and 10 (10 degrees 00 minutes) degrees North of the equator and longitude 10 (10 degrees 14 minutes) and 13 (13 degrees 17 minutes) degrees West of the Greenwich Meridian. Sierra Leone is a coastal country with a surface area of about 72,325 square kilometres and is bordered in the northeast by the Republic of Guinea, in the south and southeast by the Republic of Liberia and in the west by the North Atlantic Ocean.

The country is divided into four main physical regions, namely coastal plains, interior lowland plains, interior plateau, and hills and mountains.

The climate of Sierra Leone is tropical; although it could be classified as a tropical monsoon climate, it could also be described as a climate that is transitional between a continually wet tropical rainforest climate and a tropical savanna climate (Gabler et al., 2008). There are two seasons: the rainy season from May to November, and a dry season from December to May, which includes harmattan, when cool, dry winds blow in from the Sahara Desert.

According to Statistics Sierra Leone recorded a total population of 7,092,113 for the 2015 Population and Housing Census (PHC). This comprises a household population of 7,076,119 and an institutional population of 15,994. By type of residence, 2015 PHC reveals that 4,187,016 people live in rural areas (59.0%), and 2,905,097 people live in the urban areas (41.0%).

The country is richly endowed in natural resources, especially minerals such as diamonds, titanium bauxite, gold and rutile, and the recently uncovered iron ore on which the economy is largely based. Although 75 percent of its land is arable, only about 10 percent is cultivated, mainly for food crops such as rice, cassava, yams, and other root crops. "Sierra Leone is still a dominantly agrarian economy with 57.9 per cent of households engaged in agricultural production. The majority of those households (42.2 per cent) are headed by men, with just 15.7 per cent headed by women."

RE2: INSTITUTIONAL ARRANGEMENTS RELATED TO MRV

Sierra Leone government's climate change policy, the National Climate Change Strategy and Action Plan (NCCSAP), the Nationally Determined Contributions to the Paris Agreement and the Nationally Appropriate Mitigation Action (NAMA), complements Sierra Leone's Medium Term Development Plan (2017 – 2023) in its attempt to implement the UNFCCC.

Sierra Leone has not yet established a formal MRV system for climate activity in the country. The existing system seems ad hoc and project-driven and not programmatic and sustainable. However, attempts have been made to at least initiate a process to set a framework for climate MRV activities.

Successful NCs and BURs require robust, effective and sustainable institutional structures that allow for effective management of MRV as well as facilitating the integration of information generated into the preparation and implementation of future NDCs and an informed policy-making process. Institutional arrangements depend on national circumstances and the respective capabilities of each country.

Sierra Leone already has some institutional arrangements in place established through the implementation of enabling activities under the UNFCCC and the need to continuously build on and enhance these to minimize the expenditure of resources and maximize the effectiveness of the system.

RE3: NATIONAL GREENHOUSE GASES INVENTORY

In 2020, for direct gases, global emissions are estimated at 2724.346 Gg of CO2, followed by 228.437 Gg of CH4 and finally 0.6554 Gg of N2O. Fluorinated gas emissions are estimated at 24.937 Gg CO2-e of HFCs. PFCs, SF6, other CO2 gases and other non-CO2 gases are not estimated. Indirect gas emissions estimated only for the energy sector amount to 24.687 Gg (NOx); 342.260 Gg (CO); 2.624 Gg (SO2) and 40.639 Gg (NMVOCs).

Without FOLU, in 2020 CO2 emissions are estimated at 2724.346 Gg of which the Transport category represents 1926,190 Gg, that of Energy Industries 516,808 Gg, and that of Manufacturing Industries and construction 277,333 Gg (Figure 13). The transport category in Sierra Leone has consistently been the primary key source of CO2 emissions for years. The majority of fossil fuels imported into the country are allocated to the road transport sector with a fleet of relatively old, poorly maintained vehicles.

The methane gas emissions are mainly generated from livestock category, energy and some subcategories of the Waste sectors had a considerable contribution to the country's total emissions. In 2020, the CH4 gas emissions appeared in Enteric Fermentation (3.A.1), Solid Waste Disposal (4.A), Wastewater Treatment and Discharge (4.D), and Manure Management (3.A.2) key categories.

Nitrous oxide emissions are mainly generated by Livestock, enteric fermentation subcategories and the energy sector in the absence of FOLU. There also generated to a lesser extent by Solid Waste Disposal and Wastewater Treatment and Discharge categories of the waste sector.

Agregate direct GHG emissions in 2020 are distributed as follows out of a total emitted estimated at 7 727,813 Gg CO2-e: CO2: 2 724,436 Gg CO2-e; CH4: 126.406 Gg CO2-e and N2O: 16.899 Gg CO2-e.

Indirect gas emissions in 2020 are NOX, CO, NMVOC and SO2. NOX emissions represent a total of 21.687 Gg and are distributed as follows: 17,716 Gg coming from Transport, 2,106 Gg from the Other sectors (Commerce & Institutions and Residential), and 1,92 Gg from Manufacturing Industries and Construction.

The Transport sector was the largest source of CO emissions in 2020 with 177,614 Gg. Followed by Other sectors (Commerce & Institutions and Residential) (164,256 Gg). This result can be explained by the types of combustion, mainly of biomass in households and businesses.

NMVOC emissions in 2020 are estimated at 33,376 Gg for the Transport category, 3,164 Gg for the Others category, the rest of the relatively very low emissions account for the Energy industries and Manufacturing and Construction Industries.

In 2020, SO2 emissions are estimated 2,624 Gg mainly from Transport, and to a lesser extent from Other sectors, Energy Industries, and Manufacturing and Construction Industries. The emission levels expressed in Gg are, however, very low compared to the emissions of other indirect gases.

RE4: MITIGATION ACTIONS

Sierra Leone's vision on mitigation is drawn on the Low-Emission Climate-Resilience Development Strategies (LECRDS), to achieve GHG emission reductions in priority sectors through well-targeted programmes of activities and projects, including through the implementation of REDD+ (Reducing Emissions from Deforestation and Forest Degradation) programmes, which can deliver significant mitigation and adaptation co-benefits in Sierra Leone.

The goal is to improve energy efficiency and increase access to grid connections by 42% in 2025 and offgrid mini-grid and solar stand-alone systems by 27% and 10% respectively in 2030. Opportunities for expanding electricity generation, transmission, and distribution through a Millennium Challenge Corporation (MCC) Compact will be explored to increase access and promote technology dissemination.

The strategy for implementing mitigation measures is made up of three main required components: mitigation goals, mitigation actions, and an action plan for implementation. These provide a framework to identify, prioritize and implement actions to reduce climate risks and vulnerabilities.

RE5: FINANCE, TECHNOLOGY AND CAPACITY BUILDING NEEDS AND SUPPORT RECEIVED

Overall, Sierra Leone faces reporting challenges on greenhouse gas inventories; estimates of emission reductions and adaptation options, implementation and technical and capacity-building needs. Many constraints and gaps exist for the reporting of information and at the frequency required by the decisions of the Conferences of the Parties. The implementation of mitigation actions is a major challenge for Sierra Leone because of the multiple constraints and gaps that exist in different areas, particularly at the institutional, organizational and individual levels. Most of the constraints and shortcomings are recurrent in both sectors and fields of study.

To mitigate these shortcomings and constraints, human, institutional and methodological capacity building is essential to increase the capacity to implement technologies, monitor emissions, and calculate emission reductions resulting from policies and measures. To sustainably succeed in all these activities, Sierra Leone needs adequate financial support.

Chapter 1:
National Circumstances

1.1. Geography, Climate and Demography

1.1.1. Location of Sierra Leone

Sierra Leone is located in the northern-western part of West Africa and lies between latitudes 7(6-degrees 55 minutes) and 10 (10 degrees 00 minutes) degrees North of the equator and longitude 10 (10 degrees 14 minutes) and 13 (13 degrees 17 minutes) degrees West of the Greenwich Meridian. Sierra Leone is a coastal country with a surface area of about 72,325 square kilometres and is bordered in the northeast by the Republic of Guinea, in the south and southeast by the Republic of Liberia and in the west by the North Atlantic Ocean.

The country is divided into four main physical regions, namely coastal plains, interior lowland plains, interior plateau, and hills and mountains.

The coastline or coastal plains is relatively gentle and comprised of estuarine swamps subject to tidal flooding; coastal terraces; and alluvial plains are subject to freshwater flooding during the rainy season. Beach ridges, fringe the alluvial plains on the seaward side (Allan 1990).

The interior lowland plains, the largest of the four physical regions extend from the coastal terraces in the west to the east of Sierra Leone, occupying approximately 43% of the total land area. They rise gently from the coastal terraces to elevations of 200m in the east, where they are separated from the plateau by distinct escarpments.

At the edge of the lowland plains is the interior plateau, which covers 22% of the total land area and made up of granite that runs from the northeast of the country to the southeast. The plateau region seldom rises above 700 m and is comprised of alluvial ironstone gravel in the south eastern region, while the northern end is comprised of weathered outcrops of granitic rocks. The eastern and southern parts comprise dissected hills. In the north and east of the country are found two of the highest mountains. The highest peak on the Loma Mountains is Bintumani, which rises to 1945 m while Sankan-Biriwa on the Tingi Hills, rises to 1805 m.

The Freetown peninsula is made up of dissected mountainous Peaks with Sugar Loaf and Picket Hills being the highest.

The country is richly endowed in natural resources, especially minerals such as diamonds, titanium bauxite, gold and rutile, and the recently uncovered iron ore on which the economy is largely based. Although 75 percent of its land is arable, only about 10 percent is cultivated, mainly for food crops such as rice, cassava, yams, and other root crops. "Sierra Leone is still a dominantly agrarian economy with 57.9 per cent of households engaged in agricultural production. The majority of those households (42.2 per cent) are headed by men, with just 15.7 per cent headed by women." (SLS 2015 Thematic Report on Agriculture P1)

However, despite this natural wealth, 64.5% of the total population, of 7092113 million people (SLS, 2015 Census Report), live in poverty. Sierra Leone's 11-year civil war (1991-2002) was a large influencing factor in the deterioration of livelihoods, infrastructure, production capacity, and economy. In 2010, the country's GDP stood at approximately 2.2 billion USD (World Bank, 2010). Resilience and economic growth are priorities of the country.

About 3,937,595 (55.5%) of the population are economically active people with 39% of the economically active population being youths in the age range of 15-24 years (SLS 2015 Thematic Report on the Economy).

Figure 1: Map of Sierra Leone, and location in Africa

1.1.2. Climate and vegetation cover

a) **Current Climate conditions**:

The climate of Sierra Leone is tropical; although it could be classified as a tropical monsoon climate, it could also be described as a climate that is transitional between a continually wet tropical rainforest climate and a tropical savanna climate (Gabler et al., 2008). There are two seasons: the rainy season from May to November, and a dry season from December to May, which includes harmattan, when cool, dry winds blow in from the Sahara Desert.

b) Temperatures:

The average temperature is 26 °C and varies from around 26 °C to 36 °C during the year (Blinker, 2006; Le Vert, 2006). Mean annual temperature has increased by 0.8 °C since 1960, an average rate of 0.18 °C per decade. During the dry season, the harmattan (dry dusty cool air) causes the lowest daily country average temperature of 16 °C with a range of between 10 °C and 22 °C. However, the harmattan period in recent times has been warmer than usual.

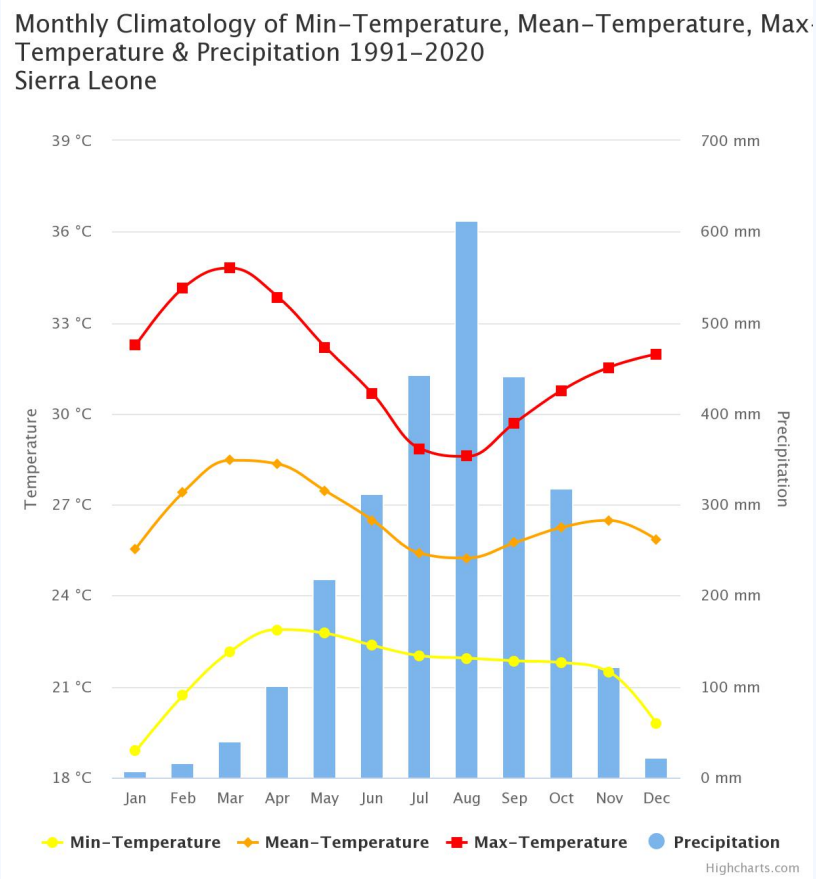


Figure 2 : Mean annual temperature and precipitation. Source: Climate Change Knowledge portal

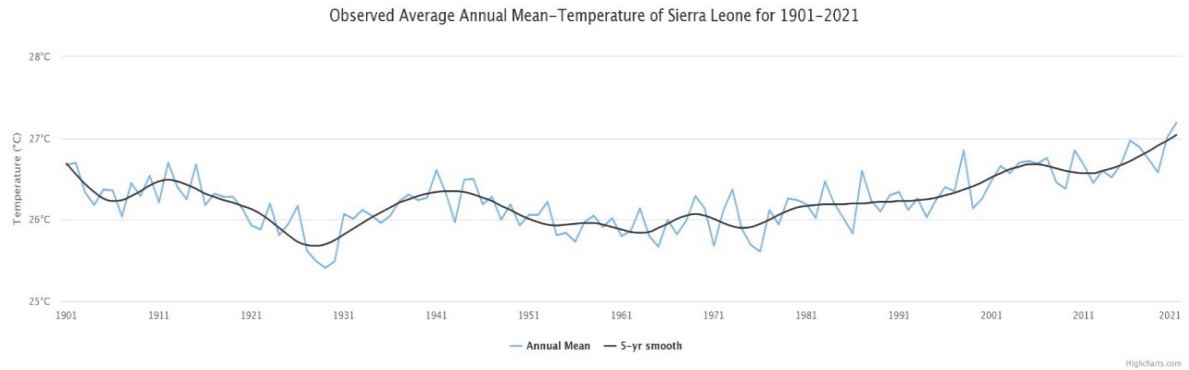


Figure 3 : Observed average annual mean temperature. Source: Climate Change Knowledge portal

c) Precipitation

The climate of Sierra Leone is divided into two seasons: the rainy and drier seasons. The months of heavy rainfall from the PRESAO Seasonal Forecast for Sierra Leone shows that from July to September (JAS Forecast) the country average rainfall is about 2746 mm and varies from 3659 mm in Bonthe in the South, 2979 mm in Lungi (Freetown) in the West and 2618 mm in the north at Kabala and Bo in the central parts of the country. Average rainfall is highest at the coast, 3000–5000 mm per year; moving inland this decreases and at the eastern border of the country, the average rainfall is 2000-2500mm (Hughes and Hughes, 1992). This rainfall season is primarily controlled by the movement of the tropical rain belt (also known as the Inter-Tropical Conversion Zone, ITCZ), which oscillates between the northern and southern tropics over the course of a year. When the ITCZ is in this northern position, the dominant wind direction in regions south of the ITCZ is south-westerly, blowing moist air from the Atlantic onto the continent.

Recently, delays in the start of rains and associated water shortages have been witnessed particularly in Freetown. Heavy rainfall following such dry spells often results in extensive flooding throughout the country. The effects of these unusual temperature and rainfall patterns on agriculture, water supply and sanitation are evident in various parts of Sierra Leone. It has also been observed that the pre-monsoon period which runs from April to June is now associated with stronger winds and more frequent rain/storms causing greater damage to lives and property. Calmer and dryer weather now appears to be associated with the September/November period which was usually characterized by frequent thunder and lightning and short but heavy rainfall.

As a typical tropical country within latitudes 7° and 10° N and being on the Atlantic coast on the West at Longitude 13° W extending eastward to longitude 10° W, the country has two main seasons wet and dry. The wet season is associated with the south westerly tropical maritime monsoon with pressure and drift originating from the St. Helene High Pressure belt gradually encompassing the northwest. The pre-monsoon period runs for two months from April to June when the predominant wind direction is South-westerly.

As the convective activity gathers strength and due to the embedded high energy, thunderstorms are frequent. The most important weather phenomenon is Squall Lines which are lines of thunderstorms and strong winds resulting from the local as well as regional frontogenesis inter-play and brought about by the sudden depression of the Inter-Tropical Convergence Zone (ITCZ). Surface winds of 60 or more nautical miles per hour (Kts) are common with Squall Lines and are sometimes accompanied by rain storms. They bring with them periodic disastrous consequences to some weakly constructed village houses and vegetation. There are instances of tree fall causing the loss of lives as in the last Kenema Airfield area were tree fall reported the death of three people in 2001. From 1961 to 2010, some five recorded squall lines caused tree falls and the destruction of homes and property in several parts of the country. This situation has changed in the last few years with more frequent and violent storms.

The wet monsoon season runs for the period July to September when the direction of wind continues to be south-westerly and the ITCZ makes its highest northward ascend. The

intensification of south-westerly moisture-laden wind is at its peak. Thus, the coastal areas of the country experience the heaviest deposit of this moisture in the form of torrential rains. These rainfall amounts decrease progressively as one moves eastwards and northwards. For the period 1961 to 2010 the country average rainfall was about 2650 mm and varies from 3614 mm at Bonthe in the south, 2865 mm at Lungi in the west (Freetown), 2358 mm at Kabala and 2585mm at Bo in the north and central parts of the country respectively.

The precipitation regime has become more erratic in the last 50 years. The mean annual rainfall over the country is about 3000mm and the southern and coastal areas receive from 3000 to 5000 mm. The rains fall steadily in the wet season with the heaviest in July and August.

The temperatures are consistently high throughout the country, roughly averaging about 28 °C. The humidity, like the temperature is usually high as a result of the heavy rains coupled with high temperature and maritime influences. Humidity rises to 93% in the wet season and decreases inland to about 47% as the rainfall declines. There is little variation in the day length due to the near-equatorial location, but sunshine hours are affected during the wet season.

The post-monsoon period of October to November has the predominant wind direction of south-westerly but with lesser strength and it signals the withdrawal phase of the rainy season and also the Southward migration of the ITCZ. During this time, thunderstorms are also very frequent due the similar high-energy surrounding air mass is weaker. Periodic squall lines result with speed of up to 60 kts at least once per season.

Seasonal temperature variations in Sierra Leone are not large. The amplitude of the average annual mean temperature (middle curve) of Sierra Leone is about 3 °C. Maximum temperature shows larger amplitude (about 5 °C) while minimum temperature has an amplitude of about 2 °C. The highest temperatures are recorded in March and resonate between February and April while the lowest temperatures are recorded in July and August. The low temperatures in July and August are mainly due to almost continuous cloudiness and rain during these months of the south western Monsoon Season. The average temperature during the dry season is about 32 ºC daytime (around 13000 hrs) and 15 ºC at night (06 00 hrs). The country is mostly humid. However, humidity is least in the northern part during the hottest period when humidity is recorded as about 40% while it is mostly above 60% throughout the year.

Since 1961 evaporation has a decreasing trend and was low in the late 1970s. It, however, picked up an increasing trend in the early 1980s. The annual rainfall is about twice the annual evaporations but the decrease in rainfall is more rapid.

Sierra Leone has a tropical climate with two distinct seasons. The dry season generally runs from December to April, and the rainy season runs from May to November. The country has six major ecosystems: Forest, Montane, Savanna, Agricultural, Wetland, Freshwater, Coastal and Marine.

1.1.3. Existing & Future Climate in Sierra Leone

The annual average rainfall in Sierra Leone is 2760 mm based on data from the Sierra Leone Meteorological Agency from 1961-2015.

Various models were used to assess future climate change scenarios for Sierra Leone, such as the GCM, HADCM, UKTR, and ECHAM. The average temperature for 1961-2015 (TNC) is about 26.7 °C. This average is expected to increase by about 7-9 percent by the year 2100. Climate data for the period 1961 to 2015 were used to construct the climate change scenarios for Sierra Leone. Data were sourced from the following meteorological stations; Lungi, Bonthe, Kabala, Njala, Makeni, Kenema and Bo. The parameters used for the study were precipitation (Rainfall) temperature, solar radiation, evaporation etc. It was evident from the study that the coastal areas experienced the heaviest rainfall in the form of Torrential rains. The study period (1961-2015) shows an average annual rainfall of about 2765 mm which varied from 3674 mm at Bonthe in the south to 2605 mm at Kabala in the North

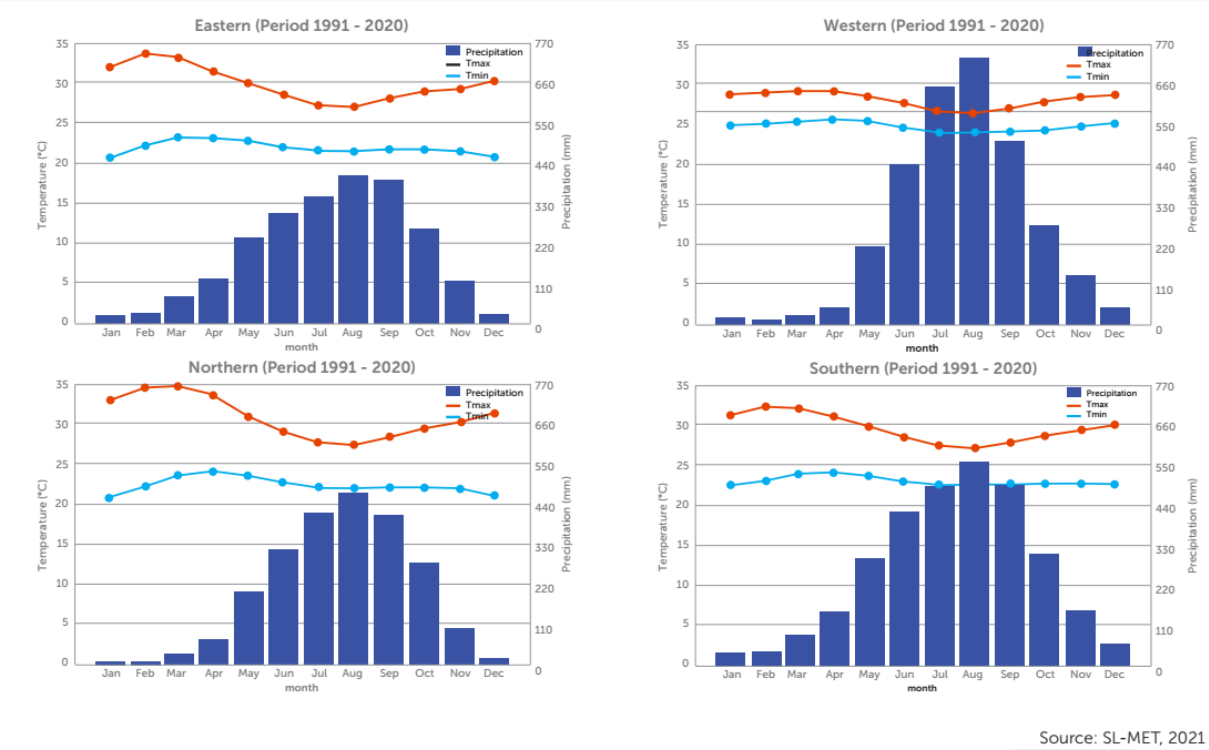


Figure 4 : Monthly climatology of both precipitation and temperature for 4 provinces.

Projections from 1961-2015 using the ECHAM4 and HDCM2 models for the rainfall values at 2100 are similar to the current climate rainfall amount, while the CSIRO-TR and UKTR models show a decrease in rainfall by about 2-8% below the current monthly and annual values. Based on the GCM outputs, solar radiation is expected to decrease by 10% under the HADCM2, by 9% under the UKTR model, and under the CSIRO-TR and ECHAM models by 5%. In Sierra Leone, based on the last

reference MAGICC/SCENGEN models, C02 concentration of about 350 parts per million (ppm) was determined in 1990. Double $C0_2$ concentration levels of about 580 ppm are likely to be achieved by 2025 and about 700 ppm by 2100. Sea level rise (SLR) scenarios adopted in this study are 0.2 m as baseline and 0.5 m, 1.0 m and 2.0 m by 2100.

There is an indication of consistent temperature warming across all seasons and scenarios. All the climate scenarios show an increase in the normal annual maximum temperature for the whole country, ranging from 1.31°C (32.13° to 34.01 °C for MIROC3.2) to 1.87 °C (29.56° to 31.42 °C for CSIRO-MK3).

The projected 1.5-2.0 °C increase in temperature results in increased evaporation losses, decreased precipitation, and a continuation of rainfall decline. (Source: TNC 2018).

1.1.4. Sierra Leone's Vulnerability to Climate Change

- **Associated actual and potential adverse impact of climate change**

According to the published report of the Initial National Communication on climate change, Sierra Leone is vulnerable to climate change and extreme weather events. The Vulnerability and Adaptation Assessment Report and the Climate Variability Report of the NAPA Project have indicated that Sierra Leone is experiencing a variety of climatic hazards which include seasonal drought, strong winds, thunderstorms, mudslide/landslides, marked temperature increase, floods, intense seasonal rainfall, shifting rainfall patterns amongst others.

In some parts of the country, notably the north and South-eastern provinces (Kambia, Kono Gbondapi, Pujehun), as well as in the Freetown area poor communities have suffered from floods and seasonal drought which have destroyed their crops and hampered their food production capabilities. Strong winds have also destroyed houses, damaged energy transmission lines and obstructed communications to remote areas of the country. Thunderstorms and heavy rain have disrupted flight schedules and caused several accidents at sea. Shifting rainfall patterns recently caused water shortage in Freetown and its environs. The changes in rainfall and temperature patterns have been causing current cropping patterns to become unsuitable for emerging climate conditions. Livestock is already experiencing greater stress due to the above climatic variability and pest and disease outbreaks are becoming more pronounced. These changes have adversely affected the ability of the rural poor to maintain their existing livelihoods and have limited the ability of Sierra Leone to maintain export earnings and pay for the importation of food.

Inadequate staff and poor facilities for weather forecasting and related activities have undermined the ability of the meteorological department to provide adequate support information to other sectors of the economy so that they can better adapt to the impact of climate change.

1.2. Population and economic profile

1.2.1. Population & Demography

According to Statistics Sierra Leone recorded a total population of 7,092,113 for the 2015 Population and Housing Census (PHC). This comprises a household population of 7,076,119 and an institutional population of 15,994. By type of residence, the 2015 PHC reveals that 4,187,016 people live in rural areas (59.0%), and 2,905,097 people live in urban areas (41.0%).

At the district level, the population figures are as follows:

- ✓ Eastern Region: Kailahun – 526,379; Kenema – 609,891 and Kono – 506,100.
- ✓ Northern Region: Bombali – 606,544; Kambia – 345,474; Koinadugu – 409,372; Port Loko – 615,376 and Tonkolili – 531,435.
- ✓ Southern Region: Bo – 575,478; Bonthe – 200,781; Moyamba – 318,588 and Pujehun – 346,461.
- ✓ Western Area: Western Area Rural – 444,270 and Western Area Urban – 1,055,964.

a) Population Growth

Sierra Leone's population has been on the increase since the 1963 census. It increased from 2,180,355 in 1963 to 2,735,159 in 1974 and 3,515,812 in 1985. From 2004 to 2015 the population has increased from 4,976,871 to 7,092,113, representing an inter-censual percentage increase of 42.5%.

The average annual growth rate between 2004 and 2015 is 3.2 percent, compared to 1.8 percent from 1985 to 2004 and 2.3 percent from 1974 to 1985. The relatively low growth rate from 1985 to 2004 (1.8%) could be attributed to the 11-year civil war.

At the regional level, the growth rate followed the same pattern since 1963 as shown by figure1.1. Between 2004 and 2015, the growth rates per region were as follows: Eastern Region -2.9 percent; Northern Region – 3.3 percent; Southern Region – 2.5 percent and Western Area –4.2 percent.

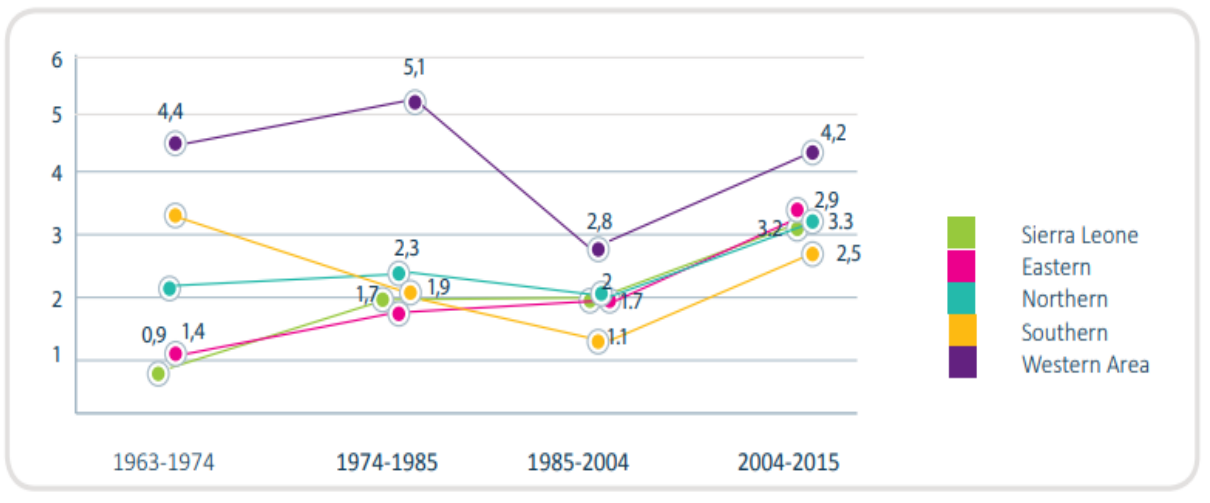


Figure 5 : Annual population growth rates from 1963-2015 by region

Source : Sierra Leone Statistics : 2015 Population Census Report

The country has about 13 tribes, eight of which are major ethnic groups that have historically resided in distinct areas of the country. The Susu, Limba, and Koranko were generally associated with the northern regions, the Temne in the central and western region, the Kono in the central-eastern region, and the Mende in the south. The Creole and Sherbro primarily inhabited coastal regions. The years of conflict, urban migration, and the mining industry have created a more mixed distribution of people in the last decades. Sierra Leone does not suffer from severe live in desperate poverty.

Sierra Leone's population almost tripled between 1960 and 2011, and it is projected to almost double again over the next 40 years. The urban annual growth rate has consistently been higher than total growth. These trends are projected to continue until 2050, when the urban population will be 59% and the rural 41% of the total, both as a result of enlargements in settlements and as a consequence of net rural-urban migration.

The population growth rate was 1.5% in 2004 increased by 1.62 in the 2015 census. The fertility index, representing the average number of children per woman (15 – 49 years old), was 6.1. According to the trend scenario, based on national statistics (2004 census report), the population was projected to reach 6.2 million inhabitants in 2014 but the 2015 census result showed a higher increase of 0.9 million above this target (7.09million) as shown by the following table:

b) Population trends in Sierra Leone's major cities

The spectacular rate of growth of population in Sierra Leone's major cities is particularly evident from the time taken to double in size taking 2004 as the base year. As projected, Freetown's population would take 24.6 years to double in size, and this would be attained by 2028. Bo's population would take 14.3 years to double in size, attaining this by 2018. Kenema's population

would take 14.7 years to double in size, attaining this by 2018. Makeni's population would take 25.1 years to double in size, and this would attained by 2029. Due to the extremely low growth rate for Koidu-New Sembehun (0.76%), it would take 91 years for its population to double, achieving this by 2095. Sierra Leone's population would take 37.9 years to double in size, and this would be achieved by 2044.

One should not fail to notice the relatively short time required for Sierra Leone's cities to double in size. With years to doubling in population size of the major cities ranging from 14 years to 25 .years (2015 Census Thematic Report and Housing), policy makers must begin to put policies in place to address the effects of this population explosion, as already scarce resources would be stretched to unbearable limits. The major social issues that would be significantly affected by this population explosion would be health, sanitation, housing, transportation, water supply and electricity supply. The consequences of failing to plan for this population explosion are catastrophic.

Table 1: Doubling of the population of Sierra Leone's major cities

City	1985	2004	Rate of growth	Years to doubling of population	Year in which the population doubles
Freetown	476,776	772,873	0.0286027	24.578572	2028
Bo	59,768	149,957	0.0496058	14.316885	2018
Kenema	52,473	128,402	0.048225	14.717045	2018
Makeni	49,038	82,840	0.0279798	25.118108	2029
Koidu	82,474	82,899	0.0076453	91.009666	2095
Sierra Leone	3,515,812	4,976,871	0.0184594	37.939297	2044

c) Population Dynamics

The 2015 PHC results reflect the demographic profile of a young population, where 40.9 percent are less than 15 years, and only 3.5 percent are 65 years and above. The working-age population (15-64 years) represents 55.6 percent.

d) Education

The 2015 PHC revealed that out of the 6,589,838 people aged 3 years and above, 55.4 percent have attended school and 44.2 percent have never attended school. Whereas of those persons 3 years and above who ever attended school, 37.2 percent are currently in school. The percentages of males currently in school (39.1%) and those who ever attended school (60.0%) are more than their female counterparts (35.3% and 50.9% respectively). The percentage of the population that has never attended school in rural areas (32.7%) is almost three times more than those in urban areas (11.5%).

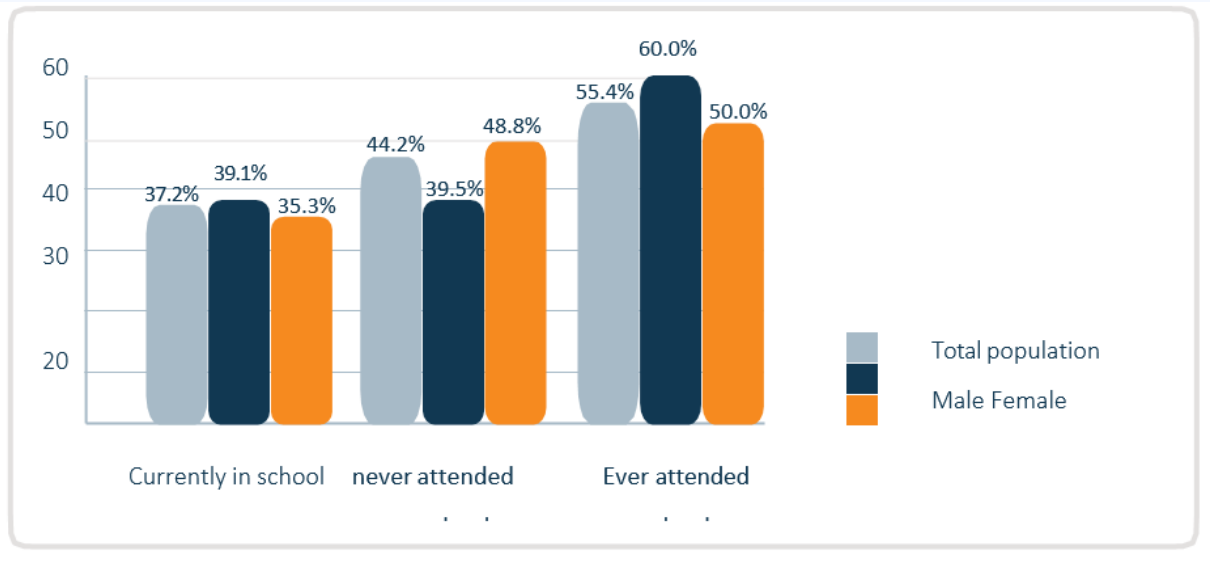


Figure 6: School Attendance for Population 3 years and above
Source: Sierra Leone Statistics: 2015 Population Census Report

e) Housing

The 2015 PHC results reveal that the total stock of houses in the country is 801,417. The proportion of houses in rural areas (60.6%) is higher than that in urban areas (39.4%). The regional distribution shows that Eastern region counts for 21.8 percent of the stock of houses; the Northern region is 34.3 %; the Southern region is 22.7 % and the Western Area 21.1 %.

The population per house is 8.8 persons and ranges from a low of 7.9 persons in the Southern region to a high of 9.4 persons in the Eastern region. On average, Sierra Leone has 1.6 households per house and ranges from a low of 1.4 in the Southern region to a high of 1.9 in the Western Area.

f) Dwelling Unit

The 2015 HPC Thematic report on housing gives 68.3% multidimensional poverty at the national level where the "finding compares favourably with the 77.5 % (close to 8 in 10 persons) multidimensional poverty index reported by the UN's 2016 Global Human Development Report for Sierra Leone; and 88.2 per cent (close to 9 in 10) based on the 2004 census data".

According to the 2015 census report on housing, there are 801,417 houses in the country with 1,265,468 households living in them. The data indicates that the total number of dwelling units nationwide is 1,347,231, of which 94.0 % are occupied and 6.0 % are vacant. As shown by figure 2.1, more than half (54.4%) of households live in separate houses, followed by flats/apartments (20.2%), compound houses (9.9%), semi-detached houses (6.8%) and the rest - including huts, tents, improvised homes, uncompleted buildings, etc. - accounting for 8.7 %.

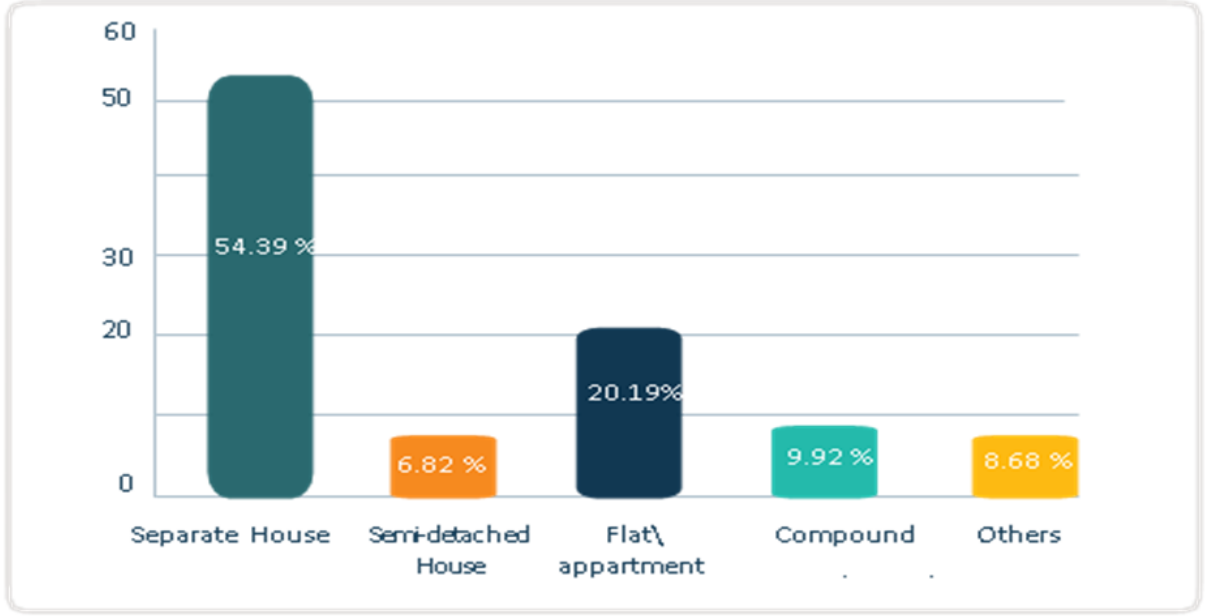


Figure 7 : Proportion of Households by type of dwelling units

Source: Sierra Leone Statistics: 2015 Population Census Report

Most Sierra Leoneans (55 %) live in separate/detached housing. Over 70 % of households are owner-occupied or rent-free and approximately 20 per cent are rented the typical house in Sierra Leone is constructed of block and steel material (approximately 70 %).
Wood (21%) and concrete "nog" (9 %) are also used.

1.2.2. Economy

Sierra Leone operates a mixed economic system; where there are prominent state enterprises alongside a viable private sector. The major sectors of the Sierra Leone economy are mining, tourism, agriculture, and manufacturing, with tourism and mining being the leading foreign-exchange earners. The economy has become more service driven overtime–presently (2007) 34.2 % of the economy can be seen as the goods sector and 72.9 % as the service sector, while in 1992, 42.6 % of the economy was goods and 39.7% in 2000.

The economy continued to progress in 2013. Real Gross Domestic Product (GDP) growth expanded further by 20.1 % (growth was 15.2 % in 2012), and the medium-term outlook remains favourable, albeit with downside risks. Implementation of structural measures under the ECF-supported program, along with better coordination of fiscal and monetary policies, helped to streamline spending and moderate inflation pressures. Helped by abundant food supply, consumer price inflation declined to single digits by end-2013 and stands currently (at End-May, 2014) at 7½ %. Domestic revenue mobilization exceeded the program target in 2013, supported by higher-than-anticipated iron ore exports, on-off budget revenues and efficiency gains from new tax administration measures. The monetary policy and financial sector vigilance remain adequate and supportive of private sector credit which expanded by 12 % in 2013. Implementation of structural

reforms progressed well in 2013 and the authorities are committed to sustain the momentum or a healthy private investment environment and growth while bolstering efficiency in revenue mobilization and improving public financial management.

a) Agriculture

Agriculture, forestry and fisheries account not only for 45% of GDP, as mentioned but also 65% of employment. Smallholder farming predominates, with average farm sizes of 1.5 ha for food crops and one to five hectares for tree crops. More than 450,000 farming households cultivate about 1.1 million ha of land. The main food crops are rice (the principal food crop in the country), cassava, sweet potato, maize, sorghum/millet, and groundnut. Tree crops such as coffee, cocoa, oil palm, and to a lesser degree cola, cashew, and rubber, are also grown. On the upland areas, which are the predominant areas used in agriculture, the principal cultivation method remains "slash and burn", with fallow periods cut shorter as population pressure increases. It is recognized that the present system contributes to land and woodland degradation and to soil erosion, affecting watershed functions and stream flow; there is great potential for improved land and water management and integrated landscape approaches to enhance productivity and longer-term soil fertility.

Inland valley swamps are mostly highly fertile, flood-prone "bottom lands" covering 1million ha in Sierra Leone**.** These areas can potentially be double-cropped or even triple-cropped, using irrigation in the dry season. To date, for a variety of reasons, only 10–15% of this land is cultivated; constraints include higher up-front costs of developing these lands for cultivation and equipment requirements, potential health issues (malaria, bilharzia), and concerns about losses from pests if a second crop is grown.

The government's strategy is to encourage farmers to move to these more fertile lowlands, thus reducing pressure on upland areas. Rice dominates the sector, accounting for nearly 60% of the total volume of production**.** In 2007, yields were estimated at 0.72 and 1.23 tons per hectare for upland and lowland rice respectively. They were 5.5 tons per hectare for cassava. Crop losses were estimated at 40%. Fertilizer use was 4 kg per hectare, amongst the lowest in Africa. Yields of other crops and livestock productivity were correspondingly low. A survey of farmers conducted in 2006 highlighted the major constraints as losses from pests and diseases; lack of access to improved seed, basic tools, and equipment; lack of financing; food for seasonal workers; and processing, milling, and marketing constraints.

b) Natural Resources

Forest and woodland cover is estimated at 2.8 million ha in Sierra Leone (38% of land area). The great majority of these (2.4 million ha) are community-managed and owned; publicly administered forests total 0.4 million ha, of which 0.19 million ha are managed for biodiversity conservation and watershed conservation and the remainder for sustainable timber production. The current forest

legislation dates from 1988, but the stated priorities of the Forest Department, under the 2010 Forest Policy, include "the three Cs" of conservation, communities and commercial forestry.

The Gola forest reserve is the largest area of primary forest in Sierra Leone, and the subject of a trans-boundary conservation program together with Liberia. The EU is supporting the establishment of the 17,000 ha Western Protected Forest Reserve near Freetown, for both biodiversity conservation and watershed protection, while USAID is assisting on a trans-boundary project with Guinea. Other partners include Irish Aid on Tiwai Island, as well as foreign and domestic NGOs such as Birdlife, Conservation International, and the Conservation Society of Sierra Leone. These programs recognize the importance of community ownership, as well as the link between biodiversity conservation and more productive agriculture, which should help reduce pressure on fragile ecosystems. There is also an appreciation of the links between conservation and tourism development, with the Ministry of Tourism now preparing an Ecotourism Strategy.

c) Marine Resources

Sierra Leone has a long tradition of fishing; fisheries comprise nearly 10% of GDP and, including indirect employment, 10% of jobs (230,000 people); fish products constitute 80% of the animal protein consumed by Sierra Leoneans**.** The industrial fleet is made up of trawlers that are owned nationally or chartered, as well as a foreign fleet established under various joint companies that target a variety of fish stocks. The local small-scale fleet includes some 30,000workers, who catch 70% of the fish consumed locally. Legal fish catch and marine products catch are estimated at 134,000 tons annually. The PRSP 2 puts a high priority on sustainable fisheries management, which is the responsibility of the Ministry of Marine Resources and Fisheries. Despite this importance, key fisheries are overexploited, and there is great scope to increase value added to the local economy.

d) Minerals Resources

In addition, existing deposits of diamonds, gold, bauxite, rutile, iron ore etc. oil were discovered in Sierra Leone's offshore waters in 2009.The government has awarded eight concessions for detailed exploration of the deep-water oil deposits; only after this work is undertaken will it be possible to determine the amount of oil that is commercially recoverable.

e) Industry

Agriculture - including forestry and fishing, crop farming, and animal production - is the largest industrial sector, employing 59.2 % of the employed population. The next major industry is services at 31.1 %, followed by industrial (manufacturing, utilities, construction and mining) accounting for 9.6 %.

Even though agriculture is the most predominant industry, data shows some variations in the proportions at the regional level. The regional disparities show that, of those engaged in

agriculture, 25.8 % are in the Northern region, 17.1 % are in the Eastern region and 14.6 % are in the Southern region. Western area, however, accounts for 15.1 % of the employed population engaged in services.

1.3. Development priorities and objectives

The environmental policy and environmental assessment (EA) legislation and procedures of Sierra Leone which are relevant to climate change are the following:

- *The National Environmental Policy (NEP):* Its relevance to climate change can be viewed in terms of the restraints that it poses to the uncontrolled use of forests, along with their natural resources;
- *The National Biodiversity Strategy and Action Plan (2003)*: Several of these priority actions relating mainly to such thematic issues as forest management, land degradation, and soil and water management have also been outlined among the key priority activities of the National Adaptation Plan of Action (NAPA).
- *The National Land Policy and Land Commission Act (2004)*: Its major influence on climate change is the power to minimise "the social and environmental implications" of the various types of land uses in the country (Government of Sierra Leone, 2005).
- *The National Disaster Management Policy (Draft):* The Policy recognizes that disaster management and risk reduction are a multidisciplinary endeavour, and while it indicates the ONS as the lead agency in this process, it stipulates that this Office is to collaborate with the decentralized government institutions, the public and private sector, UN agencies and NGOs. Importantly, the Policy gives strategic directives to the government on steps to be taken before, during and after disasters.

1.3.1. The National Environmental Policy (NEP)

As the first national policy concerning the environment the NEP, which was approved in1990 and revised in both 1994 and 2002, is a milestone document for environmental management with enormous implications for climate change. This policy highlights the general principles to be considered by all activities that have potential implications for the environment, in particular outlining the main environmental goals and objectives that underlie Sierra Leone's aspiration for sustainable development. Its relevance to climate change can be viewed in terms of the restraints that it poses to the uncontrolled use of forests, along with their natural resources.

1.3.2. The National Environmental Action Plan (2002)

Unlike the NEP, this plan (NEAP) sought to identify the specific activities that needed to be undertaken to protect Sierra Leone's environment. Most of these activities, which were intended to be integrated into any future national development plan for the country, relate to such issues as environmental education and training, environmental information systems (EIS), and the integration of NEAPs into national development plans. Because this plan also ranks and prioritizes environmental actions with a strong emphasis on protecting the security of tenure, it arguably has serious implications for climate change.

1.3.3. The National Biodiversity Strategy and Action Plan (2003)

Developed in 2003, the BSAP was formulated based on the NEAP. Its relevance to climate change is the highlighting of the state of Sierra Leone's biological and ecological resources and the threats posed to their existence. This plan specifically identifies a range of cross-sectoral actions needed to ensure the effective protection and sustainable use of the country's resources. Several of these priority actions relating mainly to such thematic issues as forest management, land degradation, and soil and water management have also been outlined among the key priority activities of the National Adaptation Plan of Action (NAPA).

1.3.4. The National Land Policy and Land Commission Act (2004)

On the other hand, the National Land Policy was formulated in response to the prevalence of land encroachment and haphazard development which has led to the intensification of vulnerability in many areas. Its major influence on climate change is the power to minimize "the social and environmental implications" of the various types of land uses in the country (Government of Sierra Leone, 2005).

1.3.5. The Environmental Protection Agency Act (2008)

The Sierra Leone Environmental Protection Agency Act (SLEPA Act) is an improved version of the Environmental Protection Act (EPA) (2000) acting as the environmental focal point for the country, to ensure that Sierra Leone complies with the relevant Multilateral Environmental Agreements (MEA's) that it has committed itself to. Prominent among these MEAs are the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, the United Nations Convention to Combat Desertification (UNCCD), and the United Nations Convention on Biological Diversity (UNCBD).

1.3.6. The Environmental Protection Agency Act, 2022

The Environmental Protection Agency Act, of 2008 established the Sierra Leone Environmental Protection Agency (SLEPA), to provide for the effective protection of the environment and other related matters. This Act mandates the EPA among others to: Advise the minister on the formulation of policies on all aspects of the environment and in particular make recommendations for the protection of the environment. The Act established the National Climate Change Secretariat to coordinate all climate actions in Sierra Leone

1.3.7. The National Security and Central Intelligence Act No. 10 of 2002

This Act established the Office of National Security (ONS) which serves as the central coordinating body for the security sector and intelligence organ of the state at the policy level. The Disaster Management Department is one of seven departments within the ONS created by this Act and this department has the mandate to coordinate all issues related to both natural and man-made disasters. It also brings together all stakeholders from governments, NGOs, United Nations specialized agencies, and community-based organisations, the private sector, media and local communities. In other words, it is the central agency responsible for disaster management.

1.3.8. The National Disaster Management Policy

The Policy recognizes that disaster management and risk reduction are a multidisciplinary endeavor, and while it indicates the ONS as the lead agency in this process, it stipulates that this Office is to collaborate with the decentralized government institutions, the public and private sector, UN agencies and NGOs. Importantly gives strategic directives to the government on steps to be taken before, during and after disasters. The objectives of the Draft Disaster Management Policy are to:

- ✓ Ensure the integration of disaster risk management into sustainable development programmes and policies to ensure a holistic approach to disaster management;
- ✓ Ensure priority and requisite institutional capacities for disaster risk reduction at all levels;
- ✓ Enhance the use of knowledge, education, training, innovation and information sharing to build safe and resilient societies;
- ✓ Improve the identification, assessment, monitoring and early warning of risks.

1.3.9. The National Commission for Relief, Rehabilitation and Reconstruction Decree, 1996 [NPRC Decree No. 12]

A DECREE to establish a Commission for the planning, co-ordination and implementation of programmes for the relief, rehabilitation and reintegration of persons and communities affected by conflict and natural and man-made disasters and other emergencies.

Table 2: Key development policies relevant to climate change

Policy Focus	Legislations/ Measures/Instruments	Relationships with Climate Change
National climate change policy	It is presently being implemented by the EPA-SL	Operates under the Climate Change Secretariat
National Environment Policy	Its presently being implemented by the EPA-SL	Operates under the Climate Change Secretariat
Environmental Assessment	A must for all medium to large projects undertaken in Sierra Leone	For protection of the Environment, Biodiversity and Ecosystem. It also has a provision for restoration after the project phase to the previous state of affairs after ever project.
Energy policy	Open the channel for investment in this sector especially by Independent Power Producer (IPP) and for easy government monitoring of the sector	Encourages Green energy/energy-efficient power generation, transmission and distribution
Renewable Energy Policy of Sierra Leone in 2016	Open the channel for investment in this sector especially by Independent Power Producer (IPP)	Encourages Green energy/energy-efficient power generation, transmission and distribution
National Transport Policy	It gives direction to MDAs in the transport sector and a clear way forward for stakeholders in the industry to follow. E.g., the importation of secondhand vehicles not beyond a stated period.	For emission reduction in the transport sector

1.4. Institutional Arrangements relevant to Climate Change

- **National Climate Change Policy (NCCP)**

NCCP is a national document developed to strengthen national initiatives to adapt to and mitigate climate change in a participatory manner that involves engaging all sectors of Sierra Leone's society with appropriate and adequate consideration for the women, youth, aged, poor and other vulnerable groups within the overall context of advancing sustainable socio- economic development in Sierra Leone. The proposed project will inform the implementation of Sierra Leone's National Climate Change Policy.

- **National Adaptation Programme of Action (2007)**

Sierra Leone has linked adaptation with its national development planning and international development goals from the start. The NAPA document was based on the goals and objectives of the Poverty Reduction Strategy Paper (PRSP) and the Millennium Development Goals (GoSL, 2007b). The NAPA specifically linked to PRSP goals to improve public health and biodiversity in support of sustainable development, while its projects were focused on immediate needs and the most urgent adaptation concerns in six sectors.

- **Strategy for the Development of a Climate Change Abatement Economy (2010)**

The Strategy focuses on opportunities for earning forest carbon credits through the implementation of REDD/REDD+ programmes. It articulates government goals to develop and manage 2.5 million ha of forests in the next decade, to assist income-generating activities of non-timber forest products, sustainable tree crops and ecotourism.

- **National Framework for Climate Services**

The National Framework for Climate Services (NFCS) for Sierra Leone is a response to the declaration of the World Climate Conference-3 held in Geneva in 2009. It is set on the premise that a national framework is necessary for strengthening the design, delivery and application of climate services across sectors and communities. The action plan allows actors within the climate action arena to meet the Global Framework for Climate Services requirements and contribute to wider national and global efforts that seek to address the effects and impacts of climate change. It will support the integration of climate science and action into decision-making at different levels and across scale, and thus, ensure that the country is fully prepared to generate and use information on the risks and vulnerabilities that may cause severe losses and damage in the long-term. This makes the NFCS one of few unique country-level attempts to highlight the importance of coordinated action to address requirements for engaging globally on matters of climate change.

- **National Climate Change Policy (2021)**

Updated through a participatory and iterative process, this NCCPF was developed following an assessment of climate risks based on its INC, NAPA, and SNC. One of the policy goals is to enhance national capacity to adapt to climate change. Its mission is "...to strengthen national initiatives to adapt to and mitigate climate change in a participatory manner that involves engaging all sectors of Sierra Leone's society with appropriate and adequate consideration for the women, the youth, the aged, the poor and other vulnerable groups within the overall context of advancing sustainable socio-economic development in Sierra Leone" (2012a). The policy makes clear the need for mainstreaming adaptation and the links between climate change and development planning. It states, "...climate change mainstreaming is imperative, which involves the integration of policies and measures to address climate change into our sectors and development planning and decision making, to ensure the long-term

sustainability of our investments as well as reduce the sensitivity of development activities to both today's and tomorrow's climate." Mainstreaming climate change into development is viewed as necessary for building a better-developed and more resilient society.

- **The National Climate Change Secretariat (2012)**

The National Climate Change Secretariat was established in May 2012 under the EPA as a Coordinating Body with a focus on ensuring that climate change activities, programmes and relevant policy development and implementation are handled promptly and in a harmonized manner. The Executive Chairperson of the EPA supervises the operations of the NSCC. The Secretariat aims to (i) ensure the mainstreaming of climate change concerns into national development planning to reduce vulnerability and promote environmental sustainability; (ii) promotion and strengthen national initiatives relating to climate change mitigation and adaptation in a participatory manner involving relevant socio-economic sectors. This Secretariate was legitimised through the EPA Act 2022 to perform the above-mentioned roles and functions.

- **National Climate Change Strategy and Action Plan (2015a)**

The NCCSAP has moved Sierra Leone's climate policy forward. It includes adaptation actions in the agriculture sector, adaptation to sea level rise, tourism sector, fisheries, forestry, health and water resources. Also contained in the plan are projects with activities and costs, and a resource mobilization strategy. The Plan will further encompass issues such as early warning systems, flood prevention infrastructure, capacity building and livelihood support and will be updated in 2021 to be cross-sectoral and focus on vulnerable sectors and communities.

- **Nationally Determined Contribution to the Paris Agreement**

The NDC's vision is "…to create a new era for a harmonious relationship between the economy, environment, social and long-term sustainability; shifts to a green economy and provides for the identification and implementation of various mitigation and adaptation measures." (GoSL, 2015b). The NDC, which was updated in 2021, aims to enhance adaptive capacity, strengthen resilience and reduce vulnerability by half by 2030. It also seeks to mainstream climate considerations into sustainable development strategies to build resilience at the local level, while promoting environmental benefits in an integrated manner at the national level. The revised NDC updates and strengthens the first NDC for both mitigation and adaptation contributions, informed by improved data collection, in-depth technical analysis and extensive stakeholder engagement. It is linked to previous climate and development policies and the initial NAP, in particular the National Climate Change Plan, NCCSAP and NAPA. The NDC is iterative, and it will be reviewed to inform the MTNDP. The NDC also includes the intention to link NAP and NDC actions moving forward. It is also explicitly tied to the NAP, with actions listed in the NDC implemented through the NAP.

Additionally, the NDC makes clear that gender mainstreaming is a key component of the MTNDP and NDC. This adds to the mandate for a gender-responsive NAP process.

- **NAP Framework**

The NAP Framework (2019) was a first step in formulating and implementing the NAP. It aims to set objectives for and determine the principles, approaches and structure of the NAP process for the country. It serves as a basis for the NAP as part of an iterative and consultative policy process.

- **Sierra Leone's climate change communications strategy under the National Adaptation Plan (2020)**

The communication strategy provides short- and mid-term direction on how the government can utilize information strategically and effectively to support the NAP process. Its goals are to: (1) improve awareness and understanding of the GoSL's climate change adaptation initiatives and the NAP process through effective communication, education and training; (2) promote an inclusive and participatory approach to adapting to climate change so that the GoSL can unite under a common vision and speak with one voice on the issue of addressing climate change impacts; (3) generate support and political commitment among key decision-makers for the NAP process and for prioritizing, managing and resourcing efforts to address climate change adaptation issues; (4) persuade the general public and the private sector of the need for a significant and timely investment in climate change adaptation from both public and private sources within and outside of Sierra Leone; and (5) encourage Sierra Leoneans to embark on activities that strengthen the country's resilience to climate change.

- **Coastal Climate Change Adaptation Plan**

The Coastal Climate Change Adaptation Plan (CCCAP) was produced through a USAID project and designed to be integrated into the NAP process. The primary vision of CCCAP is to identify and implement measures to conserve and make the best use of Sierra Leone's coastal resources while contributing to SDGs for the benefit of present and future generations. The Plan employs an ecosystem-based approach to climate change adaptation on the coast of Sierra Leone as part of efforts to foster climate resilience in the country. This will hopefully be replicated in West Africa. The outcome is to have coastal landscapes in Sierra Leone that are organized and furnished with the tools to plan for and adapt to, the impacts of climate change.

- **Institutional Arrangements for Planning and Implementing Climate Change**

Sierra Leone's institutional arrangements for planning and implementation of climate change have been evolving; and divided into five interrelated coordinated structures. The structure reflects the roles various institutions are playing in the planning and implementation of climate change in the country as envisaged in the NCCP.

EPA is the Designated National Authority (DNA) for the Clean Development Mechanism (CDM) of the UNFCCC, as well as the GEF Focal Point for Sierra Leone. EPA is also the institution coordinating

the implementation of the national communications in collaboration with the Meteorological Agency under the Ministry of Environment and Climate Change. EPA is hence the government's focal point for transparency activities and comprises the national executing entity for the CBIT project in collaboration with the Meteorological Agency. The figure below describes the key institutions expected to be involved in the National Climate Transparency System in Sierra Leone. The sectors were identified in the TNC as the most important for mitigation actions. Development adaptation indicators/metrics to measure NDC implementation will also be developed for the most vulnerable focus areas like coastal areas and water-related areas i.e. flooding and drought. The National Climate Transparency System will build on The Sierra Leone Right to Access Information Act 2013: This Act was passed in parliament to provide for the disclosure of information held by public authorities or by persons providing services for them and to provide for other related matters.

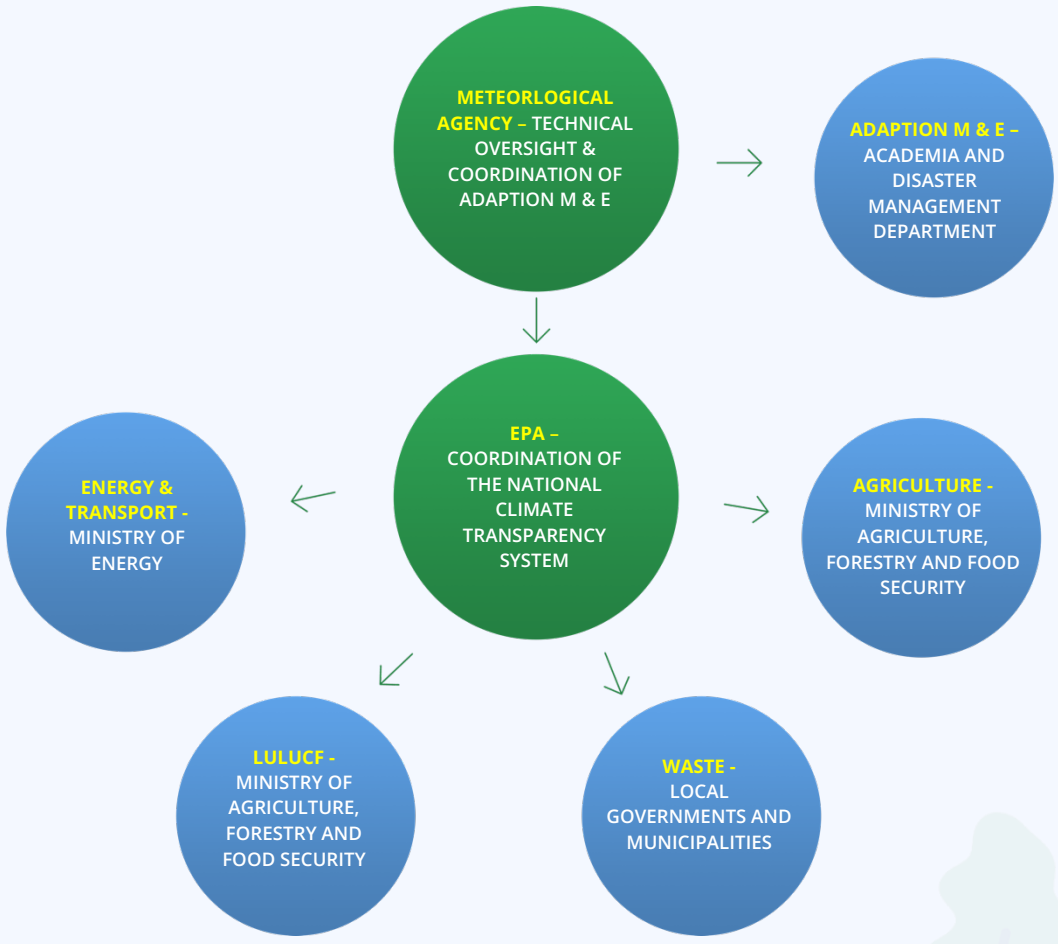


Figure 8 : Current Institutional arrangements

- **Institutional Arrangements for continuous reporting of NCs**

Sierra Leone has completed three National Communications to the UNFCCC. The INC was completed in 2007, the SNC in 2012 and the TNC in 2018. The INC includes a chapter on vulnerability and adaptation (GoSL, 2007a). Adaptation measures were included for agriculture, forests, water resources and coastal zones with a particular focus on public health. The policydevelopment process produced the first vulnerability assessments for the country. The SNC focused on agriculture, forestry, water resources, human health, coastal resources, human settlements and tourism (GoSL, 2012b). The TNC focused on agriculture, water resources, human health, coastal resources and human settlements (GoSL 2018). All three include vulnerability and adaptation interventions by sector based on limited data.

The Environment Protection Agency Sierra Leone (EPA-SL) together with the Sierra Leone Meteorological Agency (SLMET) has put in place modalities for the regular preparation and reporting of national communication to UNFCCC had evolved from ad-hoc working groups towards attaining permanent decentralized institutional representations. The institutional arrangements for national communications and Biennial Update Reports are intertwined (see Figure 2) and integrated into the superstructure for coordination of planning and implementation of climate change activities. Linkages have been established with the monitoring and evaluation structures, research and knowledge generation structures.

1.5. Priorities related to the mitigation of climate change

- **Vision 2035 Sierra Leone**

Vision 2035 articulates, "Mitigation, through reducing greenhouse gas emissions, will be addressed through greater energy conservation. Energy conservation in Sierra Leone will put us in a "win-win" situation as it provides other substantial positive economic, social and environmental benefits. It is assumed that, energy conservation efforts, the use of cleaner technologies and the the development of alternate energy will result in lower spending on imported oil, less pollution and a reduction in pollution-related illnesses. We will engage in reforestation to increase the amount of greenhouse gases removed from the atmosphere, provide improved watersheds and waterways and reduce landslides and soil erosion. These measures (energy conservation and reforestation), if pursued on a global scale, will mitigate and reduce the global rate of climate change".

- **Sierra Leone's Low Emissions Development Strategies (LEDS)**

Nationally Appropriate Mitigation Actions (NAMAs) NAMAs are an important tool for climate change mitigation since they allow policy-makers the opportunity to design mitigation measures in accordance with national circumstances and priorities as fleshed out in Low-Carbon Development Strategies and Plans (LCDS) or other relevant development plans. This enables states

to avoid the lock-in of outdated, high-emission technologies and catalyzes the transformation of the economy towards low-carbon and sustainable growth patterns. For Sierra Leone, the planning of "supported NAMAs" can open up promising new opportunities for fast-track and long-term funding by public and private actors.

The preparation and implementation of Sierra Leone's Low Emissions Climate Resilient Development Strategy is a priority identified in the Sierra Leone National Development Plan – the Agenda for Prosperity 2013 -2018. Sierra Leone is committed to mainstreaming inclusive green growth in the Agenda for Prosperity (A4P, 2012). The transition to low-emission development in both developed and developing economies has been recognized internationally as an imperative to stabilizing greenhouse gas (GHG) concentrations in line with a 2OC temperature increase scenario. Reducing emissions and maintaining a safe operating space for humanity, requires a transition to low emission development pathways around the globe. This means decoupling carbon emissions from economic growth through a series of measures across all economic sectors, such as energy efficiency improvements, usage of renewable energy sources, managing land use change and others.

- **National Energy Policy 2009-30**

In December 2009, the government tabled a National Energy Policy 2009-30 in Parliament that will lead toward developing: A modern, efficient, diversified and environmentally sustainable energy sector providing affordable and accessible energy supplies with long-term energy security and supported by informed public behaviour on energy issues and an appropriate policy, regulatory and institutional framework.

The policy places priority attention on seven key areas:

1. Security of energy supply through diversification of fuels as well as development of renewable energy sources;
2. Modernizing the country's energy infrastructure;
3. Development of renewable energy sources such as solar and hydro;
4. Energy security and efficiency;
5. Development of a comprehensive governance/regulatory framework;
6. Enabling government ministries, departments and agencies to be models/leaders for the rest of society in terms of energy management; and
7. Eco-efficiency in industries.

- **The National Transport Policy**

The National Transport Policy drafted in 2007 is guided by the vision to create a "sustainable, competitive, safe, accessible, and environmentally friendly transport network providing world-class air, land, rail, and marine facilities contributing to a vibrant import, export and trans-shipment trade for Sierra Leone and the world." The transport policy is designed to encourage energy conservation measures (e.g., efficient traffic management; carpooling; park and ride; use of clean

fuels to minimize pollution; flexible work hours and tele-commuting; an efficient public/urban mass transit transport system; and use of non-motorized transport) and promotion of vehicle and road maintenance programmes. Supporting legislation for the use of biofuels will be put in place.

Chapter 2: Institutional Arrangements Related to MRV

The arrangements/systems for MRV processes implementation may involve a variety of institutions, including governments, civil society, research organizations, and consultants. The capacity of involved institutions in the MRV system to carry out their MRV-related tasks is a crucial issue. Depending on the type of MRV, different resources and capacities are required and it is important to assess their availability.

There are various kinds of capacities necessary to develop and operate the MRV systems. The presence of appropriate institutional, human resources, technical, and financial capacity among potential reporters and programme administrators can provide a strong foundation on which to establish a reporting programme. Table 1 outlines a preliminary list of capacities required for MRV that will be considered for the MRV capacity assessment in the context of this study.

Performing MRV requires institutions that have the necessary legal mandate and framework, and clear and efficient processes.

- The ability of institutions to perform functions to achieve objectives
- Effective legal/formal institutional arrangements, processes and coordination mechanisms, leadership, and institutional mandates
- Existence of arrangements/systems for the involvements of stakeholders
- Capability to identify problems and develop and implement solutions
- Result in the long-term sustainability of the programme
- Existence of a continuous improvement plan.

Human resources are needed to perform a range of tasks and functions related to different types of MRV. Typical functions include overall planning; coordination; management and technical oversight; conducting research, data collection and management; emission calculations; climate change actions monitoring and evaluation; and quality assurance/quality control coordination:

- Capacity and skills of individual staff, including managerial abilities and technical skills
- Recruitment and retention of skilled staff
- Regular training of new and existing staff.

Technical capacity needs can be understood in terms of the availability of appropriate methodologies to obtain accurate data and adequate platforms for data collection and management:

- Availability and quality of data and information
- Retention of institutional memory, archiving, and documentation procedures
- Collection and dissemination of information
- Technical and technological infrastructure (e.g., data collection platforms and monitoring technology).

Financial capacity involves ensuring that sufficient resources are available to start and sustain the implementation of MRV. Financial resources are needed to equip governments and other relevant entities for several MRV-related tasks, such as hiring qualified professionals dedicated exclusively to performing MRV, building capacity among stakeholders to support MRV implementation, putting in place effective institutional arrangements and processes, and implementing new data collection systems and methods:

- Adequate financial resources to perform functions and achieve objectives
- Ability to manage these resources.

2.1. Government structure relevant to MRV

Sierra Leone government's climate change policy, the National Climate Change Strategy and Action Plan (NCCSAP), the Nationally Determined Contributions to the Paris Agreement and the Nationally Appropriate Mitigation Action (NAMA), complements Sierra Leone's Medium Term Development Plan (2017 – 2023) in its attempt to implement the UNFCCC.

Sierra Leone has not yet established a formal MRV system for climate activity in the country. The existing system seems ad hoc and project-driven and not programmatic and sustainable. However, attempts have been made to at least initiate a process to set a framework for climate MRV activities. Successful NCs and BURs require robust, effective and sustainable institutional structures that allow for effective management of MRV as well as facilitating the integration of information generated into the preparation and implementation of future NDCs and an informed policy-making process. Institutional arrangements depend on national circumstances and the respective capabilities of each country.

Sierra Leone already has some institutional arrangements in place established through the implementation of enabling activities under the UNFCCC and the need to continuously build on and enhance these to minimize the expenditure of resources and maximize the effectiveness of the system.

Table 3: Roles and responsibilities of stakeholders

Institutions	Roles and responsibilities
Environment Protection Agency (EPA)	The EPA was established by an Act of Parliament in September, 2008 as a body that aims to effectively protect and sustainably manage the environment and its natural resources. Due to the new EPA Act 2022, the Agency has been placed under the Ministry of Environment and Climate Change, headed by an Executive Chairperson, steered by a Board, and coordinates with both national and local Government institutions on issues relating to environmental protection and management. The Agency (i) advices government on the formulation of policies on aspects relevant to the environment as well as climate change; (ii) prescribes standards and guidelines relating to ambient air, water and soil quality; (iii) ensures compliance with relevant procedures in the planning and execution of development projects; (iv) issues EIA permits; and (v) promotes relevant studies, research, surveys and analyses. The EPA deals with climate change and almost all multilateral environmental agreements and the implementation of the Paris Agreements. The EPA has coordinated the implementation of the national communications submitted so far and will be the custodian of the developed transparency system and will integrate data into subsequent national report processes. The EPA will be a key coordinating partner throughout the preparation and implementation of the CBIT project. The online platform facilitating the coordination will be hosted by EPA.
National Climate Change Secretariat (NCCS)	The National Climate Change Secretariat was established in May 2012 under the EPA as a Coordinating Body with a focus on ensuring that climate change activities, programmes and relevant policy development and implementation are handled promptly and in a harmonized manner. The Executive Chairperson of the EPA supervises the operations of the NSCC. The Secretariat aims to (i) ensure the mainstreaming of climate change concerns into national development planning to reduce vulnerability and promote environmental sustainability; (ii) promote and strengthening of national initiatives relating to climate change mitigation and adaptation in a participatory manner involving relevant socio-economic sectors.
Ministry of Agriculture, Forestry and Food Security (MAFFS)	The Ministry of Agriculture, Forestry and Food Security is charged with the growth and development of the agriculture sector. Through its Rural Development Strategy the Ministry aims to facilitate: (i) increased competitiveness, productivity and rural wealth accumulation through smallholder commercialization; (ii) productive and sustainable management of natural resources including lowland rice and food crop production initiatives; (iii) growth in human capital, innovation and technology using

	Agricultural Business Centres; (iv) diversification in social capital, institutional efficiency and effectiveness; and (v) good governance and market planning.
National Protected Area Authority (NPAA)	The National Protected Area Authority was established by an Act of Parliament in 2012 to ensure the sustainable use of biodiversity and forest resources with regards to their benefit for soil and water conservation, economic development, wildlife habitats, and aesthetic and recreational values. The NPAA focuses on the following intervention areas: (i) biodiversity and wildlife conservation through the development of strategies for sustainable use of the ecosystem services and genetic resources; (ii) enhancement of stakeholder capacity for forest reserve management; (iii) promotion of watershed management in critical catchment areas to protect domestic water supply systems; (iv) reduction of land degradation; (v) increase support for NGOs; (vi) community tree-planting programmes.
Sierra Leone Agricultural Research Institute (SLARI)	The Sierra Leone Agricultural Research Institute (SLARI) under MAFFS is responsible for generating knowledge and technological solutions to facilitate higher yields in production, agro-business and food and nutritional security. SLARI is responsible for implementing research activities that contribute to the development of strategies for environmentally sustainable management and use of land for agricultural production. The institute is responsible for the coordination of key research programmes, in cooperation with national centres specialized in research on agricultural and horticultural crops, fisheries, forestry, as well as land and water.
Ministry of Transport and Aviation (MTA)	The Ministry of Transport and Aviation's mission is to develop policies and provide effective and efficient guidelines for the delivery of safe, reliable, affordable and sustainable maritime, land transport, aviation, and rail systems throughout Sierra Leone. The goal of the Ministry is to: (i) increase access through the provision of transport services; (ii) connect rural farming populations as well as urban poor to market centres; (iii) provide social and economic services through efficient, affordable and sustainable transport systems; (iv) effective coordination of relevant agencies resonated by policy directives and effective monitoring. The MTA includes amongst others: the National Roads Authority, Meteorological Department, Ports Authority, Road Transport Corporation, Road Safety Authority, National Shipping Company, Transport Infrastructural Development Unit and the Maritime Administration. The Roads Authority includes an environmental

	unit that aims to ensure that environmental sustainability concerns are taken into consideration during the planning, implementation and maintenance of road infrastructure.
Sierra Leone Meteorological Agency	The just-transformed Agency hosts the National Focal point for the UNFCCC and is responsible for the development of the Climate Change Scenario and the chapter on Systematic Observation and Methods of observation in National Communications.
Statistics Sierra Leone (SSL)	Statistics Sierra Leone serve as the Government agency responsible for collecting, managing, coordinating, supervising, evaluating, analyzing, disseminating and setting quality standards for statistical data for overall national socio-economic reconstruction and development. The SSL will be engaged in project preparation and implementation.
Ministry of Finance and Economic Development (MoFED)	The MoFED is the central institution charged with the responsibility to formulate, institutionalize and administer economic development, fiscal and tax policies for the promotion of sound and efficient management of financial resources of the government. The MoFED currently chairs the National Climate Change Finance Steering Committee
NGOs and civil society organizations	There are several of NGOs and civil society groups working with different Government institutions and local communities towards climate change adaptation and mitigation.
Regions and Municipalities	The five regions in Sierra Leone represent the sub-national actors and are key to ensuring a decentralized approach anchoring the impact of the project at all levels of society.

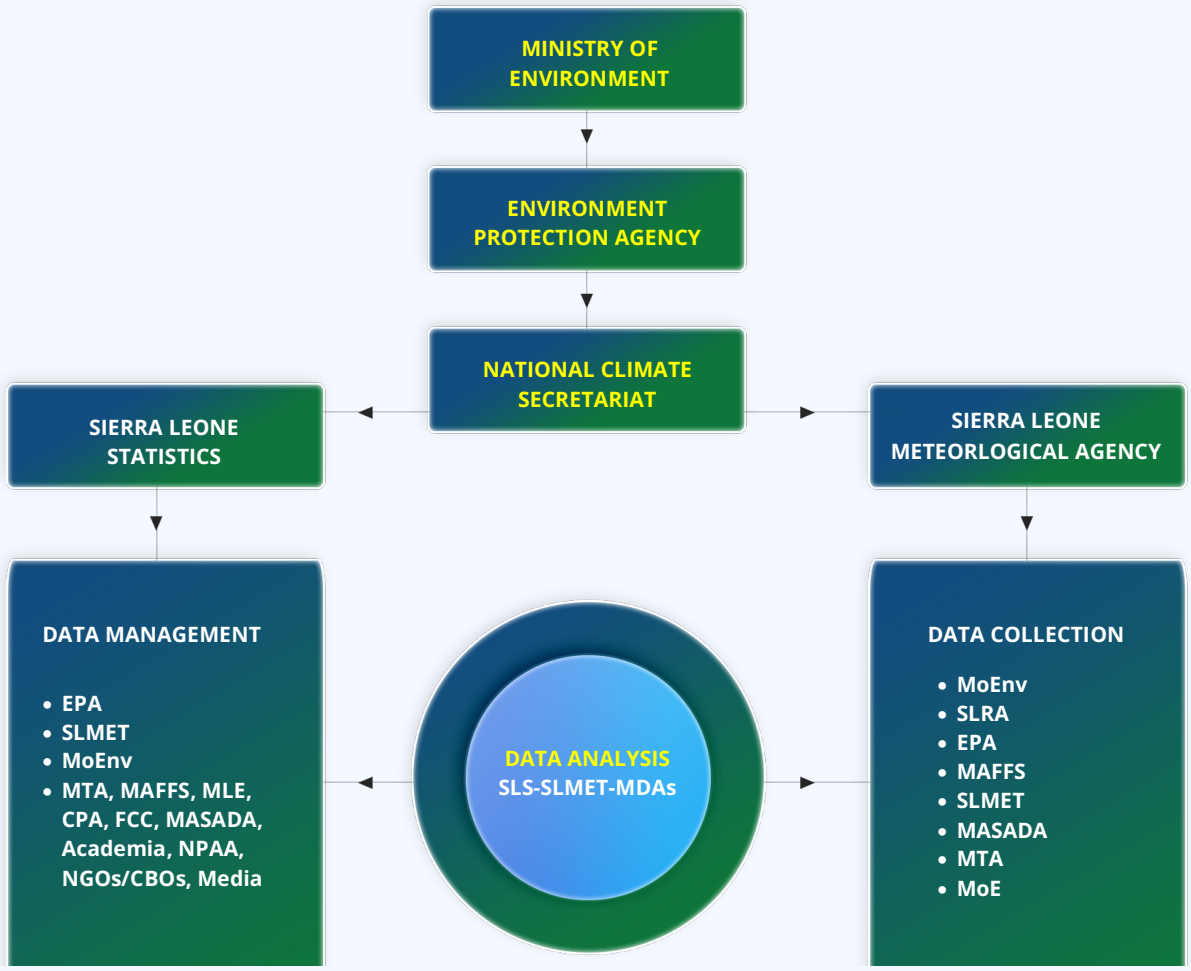


Figure 9 : MRV Institutional Arrangements

2.2. Domestic MRV arrangements for compilation and submission of National Communications and BURs on a continuous basis

Currently, Sierra Leone is in the process of developing and operationalizing its domestic MRV system under the Meteorological Agency of the Ministry of the Environment. This process is being facilitated by the Government of Canada and will focus on the setting up of a new layer of institutional structure to track the country's emissions and mitigation activities to attain both domestic and international reduction GHG targets. Sierra Leone considers this approach as an efficient and cost-effective way of mobilizing institutions and setting up processes for performing MRV functions on a sustainable basis at both project, sector, and national levels (see Figure 14). Sierra Leone's attention has been on designing a simple-to-integrate MRV structure that is acceptable and less burdensome to the identified institutions but which, at the same time, meets

the essential ingredients for MRV. Since this MRV is not seeking to integrate into the existing development M & E structures, performing this additional MRV function will require a new law.

The domestic MRV system aims at making sure that the system can "monitor." (a) GHG emissions or reductions attributed to a particular mitigation action (policy, programme, measure or project; (b) climate-related support provided by the Government of Sierra Leone or received from donors or the market in the form of finance, technology transfer, and capacity to enable implementation of a certain action or as a result of an action taken in a particular sector of the economy; (c) sustainable development benefits of mitigation actions.

In addition, it is reporting on (a) GHG Inventories, (b) mitigation actions and their effects, and (c) support received on time. All this information will be reported in the National Inventory Report (NIR) and the BUR and communicated to the UNFCCC to kick-start the International Consultation and Analysis (ICA) process, which will constitute the second layer of verification. The first layer of verification of information on GHG emissions, impacts of mitigation actions, and support will be performed by the national registry entity before it's recognized and uploaded to the online registry.

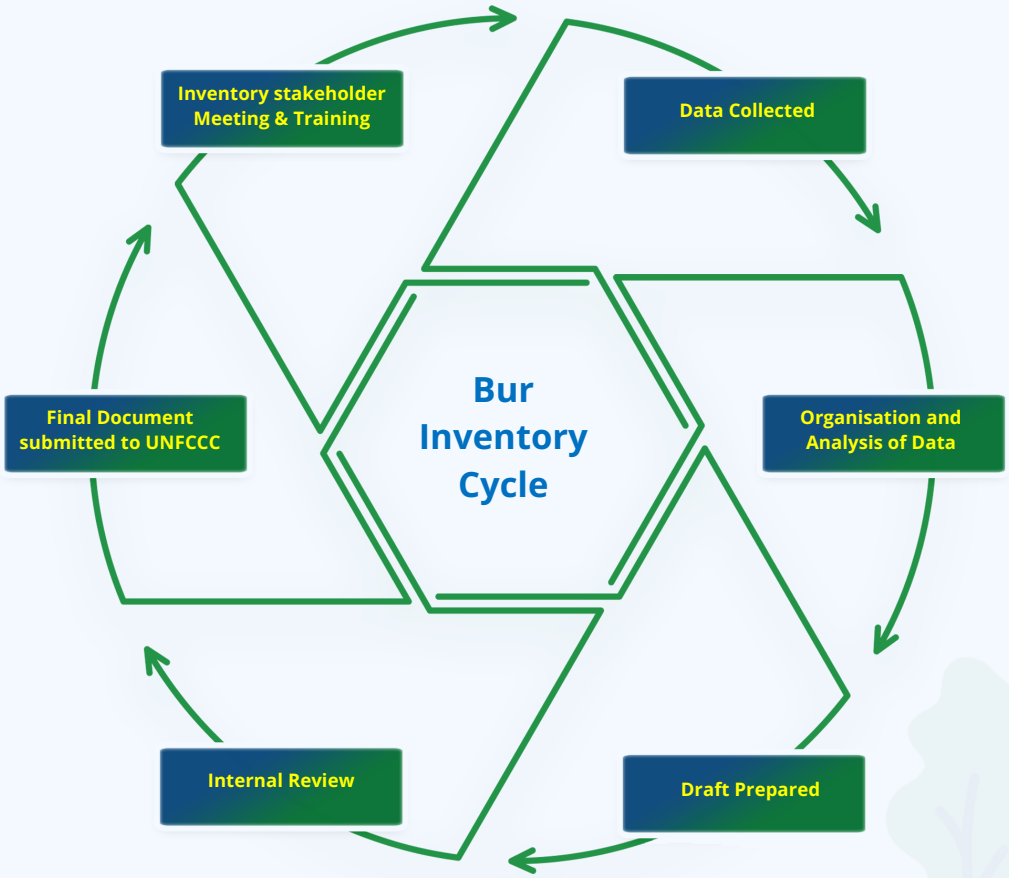


Figure 10 : The BUR inventory cycle

The National Communications identified capacity-building needs to further strengthen the reporting and monitoring of national GHG data gathered through different sectors and the implementation of standardized technical guidelines and regulations, and codes of practice for accountability and transparency. The proposed project will deliver some of these training and capacity-building needs, and at the same time build a process for the long-term sustainability of climate transparency activities in Sierra Leone.

2.2.1. National MRV System Institutional Arrangements

The country's formal institutional arrangements are almost nonexistent. However, in the attempt being made to establish a national MRV system, the national coordinating agencies had been the Sierra Leone Meteorological Agency and EPA-SL with various entities. The relationships with the different entities were to be established through formal mandates, laws and bylaws, and MOUs. The tools and existing methodologies with respect to data collection and calculation of GHG inventories are based on the UNFCCC methodologies. The data and information are collected in formats prescribed by UNFCC guidelines for inventory calculations.

The overarching objectives of the Monitoring Reporting and Verification (MRV) System will be to track the transition of Sierra Leone to a low-carbon and climate-resilient economy. This will include:

- Provision of a clear picture of the various response measures included in climate change mitigation and adaptation areas;
- Providing an assessment of the effectiveness of these response measures;
- Applying a consistent approach to these assessments to allow for greater comparability;
- Increasing coordination of climate change response measures;
- Demonstrating impact of response measures to Government and development partners;
- Increasing transparency on financial flows relating to climate responses; and
- Increasing awareness of observed and projected climate impacts.

The overarching objectives of the MRV of climate adaptation actions will be to track how the resilience of Sierra Leone's economy is enhanced. This will include:

- Provision of a clear picture of the various response measures included in climate change adaptation areas;
- Providing an assessment of the effectiveness of these response measures;
- Applying a consistent approach to these assessments to allow for greater comparability;
- Increasing coordination of climate change response measures;
- Demonstrating the impact of response measures on Government and development partners;
- Increasing transparency on financial flows relating to climate responses; and
- Increasing awareness of observed and projected climate impacts.

2.2.2. Steps taken to develop SL's National MRV system

The designing and operationalization of the domestic MRV system will be rolled out in 4 states from 2015 to 2024. The phased-out program is sequenced as follows: (a) planning and design; (b) integration; (c) piloting and testing, and (d) functional deployment.

The domestic MRV system will have different hardware and software elements that will work together as one functional unit. The arrangements of the functional units of the MRV configuration are shown in the figure below

2.2.3. Stages for developing National MRV

The CBIT outlined the various procedures and coordination for the Climate Change related MDAs by the NCCS where the proper guidelines and methodologies will be developed in the just launched CBIT project.

a) Planning and staging

- Institutional Arrangement for MRV data collection and management established under EPA's Coordination in prioritized sectors for mitigation;
- Data collection mechanism
  - The Meteorological Agency and Statistics Sierra Leone are leading institution for the collection and processing
  - Institutions to provide the needed Organisational, e.g., forestry Division on Forest data EGTC, SLRA EPA, MAFFS, SLMET, MASSADA, MTA, MoE
- Data Management mechanism
  - Sharing and backup Storage at the NCCS –EPA-SL where the website will be based
  - MOU to be developed and signed by MDAs and other stakeholders during the exercise
  - Institutions and MDAs include EPA, SLMET, ME, MTA, MAFFS, MLE, CPA, FCC, MASADA, Academia, NPAA, NGOs/CBOs, Media
- Continuous quality control and assurance program for Sierra Leone's transparency instruments designed (e.g., National Communications, Biennial Communications)
- Training of more staff of SLMET and related data institutions for proper collection of Meteorological, Hydrological, Environmental, and Climate Data collection
  - SLMET, MWR EPA-SL
- Development of a Quality Control Standard Operation Procedures Manual for GHG emission and sink Assessment
  - Stakeholders in the various GHG Sectors development, especially MOHS, Standard Bureau, ME, MTA, MAFFS, EPA-SL, MWR
- Data teams from the prioritized sectors trained in the collection, processing, and

management of data

- Training of Trainers and subsequently trainees for Data collection, processing, and sharing in prioritized sectors
    - EGTC, SLRA EPA, MAFFS, SLMET, MASSADA, MTA, MoE
- Training of data collectors in each sector, especially Energy, AFOLU, and Waste, to collect process and share data.
    - EPA, Academia, SLMET, MAFFS, MTA, MoE, FCC
- Data Collation, Analysis and eventual proper Management of the Data Collected together with storage by relevant MDAs
    - Principal advisers, ME, EPA-NCCS, SLMET, ME, MAFS NPAA, CSSL, SLS
- Peer-to-peer learning activities in the region for key stakeholders undertaken and through participation in the CBIT Global Coordination Platform
- School involvement in the process through the creation of School Clubs that will help to disseminate the issues with key players as:
    - MBSE, MRU, ECOWAS, NCCS, MDAs
- Undertake study tours to countries within the African region that already started implementing their CBIT.
    - EPA-NCCS, SLMET, ME, MAFFS NPAA, CSSL, SLS
- Training on report writing, Monitoring, Reporting and Verification (MRV) by national and international consultants for All Sectors
    - MBSE, MRU, ECOWAS, NCCS, MDAs

b) Planning and staging during follow-up

This will be treated in detail when implementing the country's Enabling Activity under the just approved CBTI, where at the planning stage, the roles and responsibilities of the Ministry of the Environment (SLMET as the technical coordinating entity), Statistics Sierra Leone, Ministries of Finance, Energy, Agriculture, Forestry and Food Security, Transport and Lands, Housing and Country Planning within the MRV system, will be determined through consultations.

c) **M&E and MRV Integration**

The MRV setup will be integrated into the existing development of M&E both at the national, sectoral and probably the district levels where possible. As part of the integration process, indicators for mitigation actions, effects, and co-benefits for key policies and measures will be developed and included in the national M&E framework. The M&E framework will track the implementation of national and sector policies and programmes and report annually in the Annual Progress Report (APR). The national APR is a compilation of sector APRs. The APR will then become the main M&E framework for monitoring the implementation of mitigation actions and their GHG

impacts and co-benefits. Within the new framework, the Ministry of Finance will continue its annual survey of climate finance inflows and domestic contributions through the national budget. The existing annual report submitted by the industry to regulatory bodies such as the EPA and Energy Commission will be used to monitor facility-level reporting.

MRV/M&E templates will be developed and incorporated into the existing reporting template. Regular hands-on training will be organized for data providers and data network owners.

d) Pilot, Test, Deployment, and Upgrades

By 2020 the full functional domestic MRV system will become operational after the initial sector Piloting and Testing. The MRV setup will be piloted in the Forestry and Energy Sectors to test the capability range of the system. The feedback from the pilots will be used to update the MRV system before full deployment begins in December 2020. Regular biennial system-wide audits and stakeholder consultations will be performed to identify areas of improvement.

2.3. MRV system for the national GHG inventory

The Sierra Leone Meteorological Agency (the UNFCCC National Focal Point) was the overall lead MDA that worked with the Environment Protection Agency-Sierra Leone (the GEF National Focal Point) and its National Climate Change Secretariat (NCCS). The two agencies worked in partnership with relevant MDAs and Civil Society Organisations to solicit GHGs data for each of the relevant GHG sectors. The project implementation was directed by the Project Steering Committee (PSC) for approval of the work plan and budget disbursement. Under the three enabling activities/ projects, the sectors only provide the data, while the project performed the emission calculations through a GHG inventory task force set up by the projects.

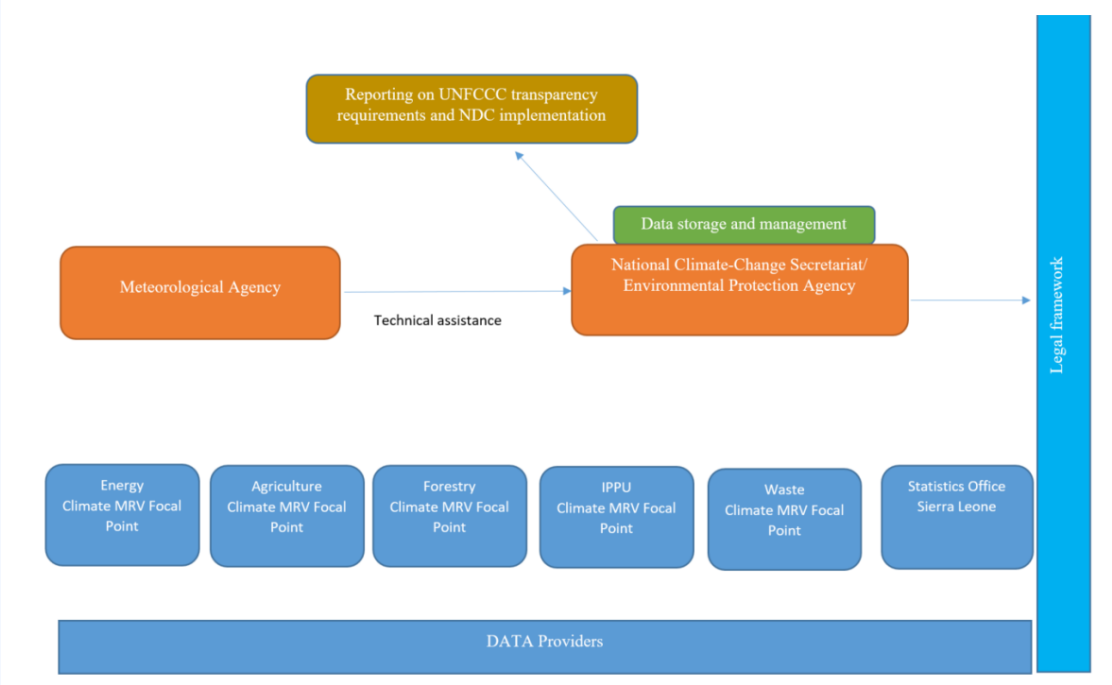


Figure 11 : Current institutional arrangements for national GHG inventory

Improvement Plan

Sierra Leone hopes to strengthen the accurate reporting of greenhouse gas emissions by undertaking the following the following activities:

- One of the CBIT activities is having Sierra Leone Statistics and the Sierra Leone Meteorological Agency with the EPA-SL coordination to liaise with various industries especially the Sierra Leone Brewery, Flour Mill, Cement Factory and others to source information on their production for 2020
- EPA-SL and SLMET to launch a system and database to update all activity data required for the GHG inventory on an annual basis which will significantly speed up the inventory process and should allow for annual monitoring of GHG emissions.
- National GHG Inventory Team to examine options for improving activity data used for the GHG inventory to minimise uncertainties associated with the inventories and therefore allow for more accurate estimates to be made.
- National GHG Inventory Team to consider exploring possibilities of introducing country-specific emission factors derived from detailed data on carbon contents in different batches of fuels used, or from more detailed information on the combustion technologies applied in the country, to reduce the uncertainties and the trends over time be better estimated. The Team will require capacity building to perform the aforementioned activities.
- EPA-SL to develop and sign a MoU with the Freetown City Council and other municipalities' Waste Management, Ministry of Environment, Ministry of Local Government and Ministry

of Health and Sanitation to facilitate smooth data (e.g., waste generation from landfills) sharing between the and among their respective institutions.

- The need for the Sierra Leone Meteorological Agency- UNFCCC Focal Point to either engage local experts or the Ministry of Lands' Surveys Unit or the EPA-SL GIS section to map out the current land use plan since the current status is not included in the past plan/document.
- That the system used for this update data collection in the Energy and AFOLU sectors is continued and extended to the other sectors in subsequent documentation.

2.4. MRV system for mitigation actions

2.4.1. Nationally Determined Contribution NDC

Sierra Leone's Nationally Determined Contribution NDC in response to decisions adopted at the 19th and 20th sessions of the Conference of the Parties to the UNFCCC, invites Parties to communicate to the Secretariat their INDCs, towards achieving the objective of the UNFCCC as set out in Article 2 of the Convention. The national circumstances of Sierra Leone have been fully taken into consideration during the development of the NDC. This includes national and sectoral strategies which already exist in the National Development Plan–the Agenda for Prosperity. A review of the current status of implementation of the cross-cutting issues of the Climate Convention at the national level has been documented. These include (a) research and systematic observation systems; (b) technology transfer; and (c) education, training and public awareness. The process is also built on the participatory multi-stakeholder and cross-sectoral consultative processes at national and district levels. Monitoring, Reporting and Verification of the implementation of the NDC of Sierra Leone have been articulated to track the transition of Sierra Leone to a low-carbon and climate-resilient economy. It will be necessary to develop and apply an integrated framework for measuring, monitoring, evaluating, verifying and reporting results of response (mitigation and adaptation) actions and the synergies between them. Effective implementation of the NDC is highly dependent on the internal "feedback" generated through monitoring, reporting and verification (MRV) processes.

2.4.2. Institutional Arrangement for the Mitigation Options

To address the rampant deforestation of the country's Protected Areas including the Gola Forest and related ecosystem and biodiversity, the Government created by an Act of Parliament: the Protected Area Authority (NPAA). It was created in time and coincided with the REDD/REDD+ Readiness plan. From the initial Country Needs Assessment (CAN) in the forestry sector, a comprehensive inventory of the country's forest resources was compiled and the Ministry of Agriculture's Forestry Division and the NPAA were lead MDAs working in collaboration with other line MDAs.

The Electricity Generation and Transmission Company (EGTC) and the Electricity Distribution and Supply Agency (EDSA) are both regulated by the relevant commission that was so established.

Legislation governing environmental issues are found as Acts and regulations of the various Government Ministries, Departments and Agencies (MDAs) through their line ministries or institutions.

In Sierra Leone, issues relating to environmental management are under the direct supervision of the Environment Protection Agency-Sierra Leone (EPA-SL) and it Powers are eschewed within the EPA-SL Act of 2008 as amended in 2010.

The Agency has a Board that is the highest decision-making body of the Agency. In view of the above, the EPA-SL has developed and outlined methods and approaches for project implementation especially those that will have a direct bearing on the environment and its ecosystem and biodiversity. Thus, the present Environmental Health and Social Impact Assessment is a prerequisite for the issuance of an environmental Impact license that gives official authorisation of the project with respect to environmental management

Before its enactment, the Environment Protection Agency – Sierra Leone was under the Ministry of Lands, Country Planning and the Environment. The Agency was however place under the office of the President for direct supervision reflecting the importance the then government attached to environmental issues. This however created some administrative bottlenecks ranging from who does what to who represent what issues. This became visible in the delay of our ratification of some of the conventions including the Paris Agreement (PA) where the Ministry of Foreign Affairs and International Cooperation took the workload from the Ministry.

To overcome this huddle and with much relief in meeting the development plane of Cluster 7 of the New Direction, which deals with Disaster, Environment and Climate Change in line with the SDG Goal 13 of the United Nations, the long-awaited Ministry of the Environment was enacted in 2019. The new Ministry incorporated some environment/climate change related Ministries, Departments and Agencies such as NPAA, Meteorological Agency, Disaster Management Department etc.

Sierra Leone reported in its BUR, mostly in accordance with paragraphs 14–16 of the UNFCCC reporting guidelines on BURs, information on finance, technology and capacity-building needs and support received.

In its BUR, Sierra Leone reported information on constraints, gaps and needs in relation to its ambition to respond to the effects of climate change through mitigation and its capacity to adapt. Constraints and gaps, which were identified for different sectors in the BUR, were described in detail.

2.5. MRV of support needed and support received

Sierra Leone is in the process of setting up a domestic MRV system with a component which will be based on an integrated tool that seeks to provide a dashboard for tracking climate-specific funds, international financing inflows and national climate-relevant budget and expenditures.

Presently, it is not clear, which Ministry leads Sierra Leone climate finance tracking. Sierra Leone has not developed any set of climate change finance tools to track the country's financial resources generated for climate change actions or external sources.

Chapter 3:
National Greenhouse Gases Inventory

This chapter presents an update of Sierra Leone's Greenhouse Gas (GHG) Inventory, covering the year 2020 as part of the First Biennial Updated Report (BUR1).

This inventory was established in accordance with the UNFCCC guidelines contained in decision 2/CP.17 and the 2006 IPCC Guidelines for estimating emissions by sources and removals by sinks of GHGs. It covers four (04) sectors, namely: Energy, Industrial Processes and Product Use (PIUP), Agriculture, Forestry and other Land Use (AFAT) and Waste.

Due to the lack of country-specific emission factors, tier 1 methodologies were mainly used. The 2006 IPCC inventory software (version 2.871 released on August 22, 2023) was used for all categories. In general, default emission factors provided by IPCC 2006 Guidelines were used with country-specific physical characteristics (Net calorific values, densities) of fuels available (Table 3.10). In addition, the approaches used during Sierra Leone Third National Communication (TNC) for data estimation were used.

3.1. Inventory overview

In accordance with Decision 2/CP.17, anthropogenic emissions by sources and removals by sinks of GHGs not regulated by the Montreal Protocol are estimated on behalf of Sierra Leone for the period 1995 to 2020 with 2020 as the reference year. The estimates relate to direct gases (CO2, CH4, N2O), indirect gases or ozone precursors (NOx, CO, NMVOCs and SO2), fluorinated gases (HFCs, PFCs, SF6, etc.).

The inventory was carried out in accordance with the 2006 IPCC guidelines and the EMEP/CORINAIR emissions inventory guide (2019). The activity data used were collected, as a priority, from institutions and national databases, then supplemented, if not available, by international data. IPCC default emission factors were used, in the absence of country-specific emission factors.

The methodological level 1 (Tiers 1 or T1) of the IPCC was applied for all the sub-categories. The EMEP/CORINAIR Emissions Inventory Guide (EEA, 2019) served as the methodologies and basis of emission factors (EFs) to estimate precursor emissions. For this GHG inventory, the EFs are collected in the IPCC Emission Factor Data Bank (BDFE) and sectoral data in institutions holding national and international statistics. Some gaps in the data were filled using extrapolation and interpolation methods.

To Improve the quality of GHG inventories in the BUR1, we take into account the results of QA/QC procedures.

The IPCC Inventory Software, Version 2.871 released on August 22, 2023 was used to compile the results. Emissions are expressed in original units (Gg) for direct and indirect gases and in tons of CO2 equivalent (Gg CO2-e) for direct gases, by converting them according to their global warming potential (GWP, SAR) (CO2:1; CH4: 21; N2O: 310).

The IPCC defines as a key source category any priority category in the national inventory system whose estimate has a significant effect on the country's total direct GHG inventory in terms of the absolute level of emissions and removals, trend of emissions and removals or uncertainties associated with emissions and removals.

When the term "key source category" is used, it includes both source and sink categories. Approach 1 based on level assessment identified key categories by sector for the year 2020.

This report presents a summary of trends in Sierra Leone's GHG emissions and removals between 1995 and 2018. The reported GHG emissions and removals do not contain information from certain categories for two main reasons: either the activities are not taking place, or the data and information necessary for their estimates are not available.

3.1.1. Institutional Arrangements for GHG Inventory

In the development of Sierra Leone Initial National Communication (INC), Second National Communication (SNC) and Third National Communication (TNC) to UNFCCC, the preparation of national GHG Inventory was conducted by a consulting team consisting of universities and research agencies. The involvement of related line ministries and national agencies was very limited. In the INC, the involvement was only in the consultation processes during the development of the report, while in developing SNC, these institutions were more actively engaged in providing activity data and in the process of inventory review. Under such a process, the production of the GHG Inventory might not be sustainable in the long term. Therefore, the high involvement of these institutions in the development of the regular inventory system is critical to better facilitate the process to improve the quality of the inventory, to facilitate the development of quality assurance and quality control (QA/QC) process for improving the quality of activity data, and to document and archive the data and information.

The use of bottom-up approach will require capacity building for national, regional/sub-national teams, particularly the capacity to use IPCC methodology for the development of GHG inventory.

Although the national institutional arrangements for GHG Inventory during Initial National Communication (INC), Second National Communication (SNC) and Third National Communication (TNC) processes were very weak, the proposed national institutional arrangements for GHG inventory in this section build on lessons learned in good practice to improve it. The different characteristics (summarized in figure 1) of this framework are:

- The Sierra Leone Environmental Protection Agency (SL-EPA). The SL-EPA is established and designated as the National Entity for National Communications on Climate Change (CNCCs) activities and Biennial Update Reports (BURs). The SL-EPA also functions as national entity for GHG inventory, collaborates with the inventory stakeholders to undertake management of activity data and emission factors, compilation of emission estimates from the sectors, quality assurance and quality control (QA/QC), uncertainty assessment, improvement planning, preparation of the reports and management of the archiving system.

- A National Study Team (NST) on GHG inventory: Coordinator of National GHG inventory. The NST on GHG inventory is composed of:

    - *Inventory Director/Coordinator*
    - *Data Collection Lead*
    - *Energy Sector Lead*
    - *Industrial Process Lead*
    - *Agriculture Sector Lead*
    - *Forestry and Other Land Use (FOLU) Sector Lead*
    - *Waste Sector Lead*

- *Archive (Data and Document) Manager/Coordinator*
- *QA/QC coordinator*
- *Uncertainty Analysis coordinator*

The National Institutional Arrangements for Greenhouse Gas Inventory (GHG) Management is composed of the Sierra Leone Environment Protection Agency (SL-EPA), a National Study Team (NST) responsible for the coordination of six (6) Working Groups (WGs) which constitute the technical architecture in the different sectors: Energy, Industrial Process and Product Use (IPPU), Agriculture, Forestry and Other Land Use (AFOLU) and Waste (fig.12).

Six (6) working groups constitute the technical architecture of the National Study Team (NST) on GHG inventory:

- *The Data Collection Working Group. Coordinator: Sierra Leone Statistics (SLS) and also includes coordinators of IGES thematic groups.*
- *The Energy working group. Coordinator: Ministry of Energy: Directorate of Policy Planning & Evaluation and is composed of institutions concerned by the sector.*
- *The Industrial Processes working group. Coordinator: Faculty of Chemistry and is composed of institutions concerned by the sector.*
- *The Agriculture Working Group. Coordinator: Faculty of Agriculture and is composed of institutions concerned by the sector.*
- *Working Group on Forestry and Other Land Use. Coordinator: MAF: Directorate of Forestry and is composed of institutions concerned by the sector.*
- *The Waste Working Group. Coordinator: Ministry of Health and Sanitation (MOHS): Environmental Health Division (EHD) and is composed of institutions concerned by the sector.*

As for the National Study Team (NST), the Working Group (WG) members are drawn from relevant public institutions, the private sector, universities, and the knowledge community and are designated based on competence, experience and relevance.

The different articulations of the institutional framework proposed for this purpose are:

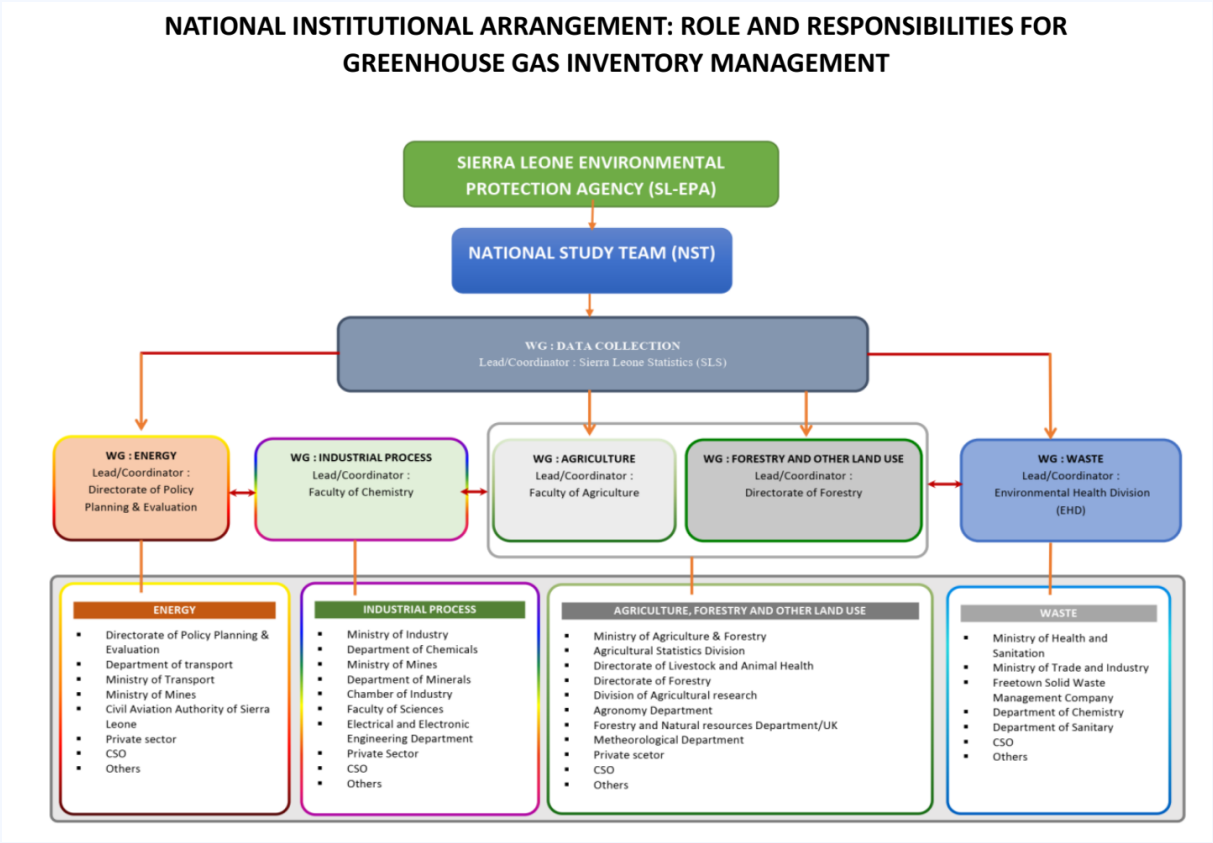


Figure 12 : Arrangement of the institutional framework for the compilation of GHG inventory

3.1.2. Preparation of the inventory, collection, processing and archiving of ADs

The planning of the main tasks in the preparation of GHG inventories has been guided by the reporting requirements and recommendations contained in the UNFCCC guidelines for the preparation of National Communications from non-Annex I country Parties (decision 17/ CP.8) and the UNFCCC guidelines for reporting the biennial update report of Parties not included in Annex I to the Convention (decision 2/CP.17, paragraphs 39-42 and annex III).

The institutional arrangements are modelled on the manuals of procedures for the preparation and management of national GHG inventories of Party countries not included in Annex I to the Convention. These provisions are also based on the United States Environmental Protection Agency (EPA) GHG inventory system model. The GHG inventory compilation cycle for this report is as follows:

- Organization of reframing sessions and harmonization of understanding of the terms of reference of the inventory process between the national coordination of the project and the members of the sectoral teams;
- Training of the pool of national experts on the 2006 IPCC guidelines and the use of the IPCC 2006 software;
- Documentation on former national communications and biennial reports of Sierra Leone and other non-Annex 1 countries;

- Documentation of the guidelines and methodological guides of the IPCC;
- Identification of data needs based on IPCC guidelines and methodological guides;
- Identification of priorities and gaps;
- Development of data collection tools by the various sectoral teams;
- Collection of activity data (AD), emission factors (EMF) and other relevant information;
- Quality control of the data collected and purification;
- Data processing in a format compatible with the IPCC 2006 software;
- Data entry in IPCC 2006 software;
- Processing of results: calculation of GHG emissions and absorptions;
- Execution of quality control and archiving procedures;
- Drafting of the GHG inventory report according to the recommended framework;
- Internal and external review of the inventory report by the identified resource persons, the coordination of the IGES, and the national coordination of the IGES;
- Validation of the GHG inventory report.
- Execution of quality assurance procedures and evaluation of the report by international experts.

3.1.3. Total GHG emissions for the year 2020

The GHG inventory for Sierra Leone covers all the four IPCC sectors, namely: Energy, Industrial Processes and Product Use (IPPU), Agriculture, Forestry and Other land-use (AFOLU) and Waste except the FOLU subsector. The inventory was compiled using the methods provided in the 2006 IPCC-Guidelines. Sierra Leone's GHG inventory reported in BUR1 is for the calendar year 2020 and this was the most recent year in which data is available.

Sierra Leone's last GHG inventory, reported in the Third National Communication (TNC), was submitted to the UNFCCC in 2018, with 2005 being the reporting year. The main gases covered are carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O). Not all emission categories of the 2006 Revised Guidelines were reported in the chapter of the National Communications.

The national GHG inventory presented in this BUR1 is updating the one contained in the Third National Communication (TNC) of 2018.

The summary of total GHG emissions and removals was estimated for the year 2020. GHG emissions and removals in 2020 are summarized in Table 4: NAI Table 1 & Table 2.

Table 4: NAI Table 1 & Table 2

Inventory Year: 2020							
Greenhouse gas source and sink categories	Net CO2 (Gg)	CH4 (Gg)	N2O (Gg)	CO Gg	NOx (Gg)	NMVOCs (Gg)	SOx (Gg)
Total National Emissions and Removals	2724,43622	228,5874	0,6554	342,2596	21,6873	40,639041	2,62385
1 - Energy	2720,33124	5,608897	0,1482	342,2596	21,6873	40,639041	2,62385
1A - Fuel Combustion Activities	2720,33124	5,608897	0,1482	342,2596	21,6873	40,639041	2,62385
1A1 - Energy Industries	516,808301	0,020923	0,0042	0,112849	0,0453	0,005573	0,32295
1A2 - Manufacturing Industries and Construction (ISIC)	277,332923	0,011228	0,0022	0,247	1,92	0,093568	0,1759
1A3 - Transport	1926,19002	0,732331	0,0912	177,614	17,616	33,376	1,917
1A4 - Other Sectors	0	4,844414	0,0506	164,2858	2,106	7,1639	0,208
1A5 - Other	NE	NE	NE	NE	NE	NE	NE
1B - Fugitive Emissions from Fuels	NE	NE	NE	NE	NE	NE	NE
1B1 - Solid Fuels	NE	NE	NE	NE	NE	NE	NE
1B2 - Oil and Natural Gas	NE	NE	NE	NE	NE	NE	NE
2 - Industrial Processes	NE	NE	NE	NE	NE	NE	NE
2A - Mineral Products	NE	NE	NE	NE	NE	NE	NE
2B - Chemical Industry	NE	NE	NE	NE	NE	NE	NE
2C - Metal Production	NE	NE	NE	NE	NE	NE	NE
2D - Other Production	NE	NE		NE	NE	NE	NE
2E - Production of Halocarbons and Sulphur Hexafluoride				NE	NE	NE	NE
2F - Consumption of Halocarbons and Sulphur Hexafluoride				NE	NE	NE	NE
2G - Other (please specify)	NE	NE	NE	NE	NE	NE	NE
3 - Solvent and Other Product Use	NE	NE	NE	NE	NE	NE	NE
4 - Agriculture	0	192,0127	0,5033	NE	NE	NE	NE
4A - Enteric Fermentation		182,8793		NE	NE	NE	NE
4B - Manure Management		9,133369	0,5033	NE	NE	NE	NE
4C - Rice Cultivation		NE		NE	NE	NE	NE
4D - Agricultural Soils		NE	NE	NE	NE	NE	NE
4E - Prescribed Burning of Savannas	NE	NE	NE	NE	NE	NE	NE
4F - Field Burning of Agricultural Residues	NE	NE	NE	NE	NE	NE	NE
4G - Other (please specify)				NE	NE	NE	NE
5 - Land-Use Change & Forestry	NE	NE	NE	NE	NE	NE	NE
5A - Changes in Forest and Other Woody Biomass Stocks	NE			NE	NE	NE	NE
5B - Forest and Grassland Conversion	NE	NE	NE	NE	NE	NE	NE
5C - Abandonment of Managed Lands	NE			NE	NE	NE	NE
5D - CO2 Emissions and Removals from Soil	NE			NE	NE	NE	NE
5E - Other (please specify)	NE	NE	NE	NE	NE	NE	NE
6 - Waste	4,10497103	30,9658	0,004	NE	NE	NE	NE
6A - Solid Waste Disposal on Land		4,278181		NE	NE	NE	NE
6B - Wastewater Handling		26,68762	0,004	NE	NE	NE	NE
6C - Waste Incineration	0	0	0	NE	NE	NE	NE
6D - Other (please specify)	4,10497103	0	0	NE	NE	NE	NE
7 - Other (please specify)	NE	NE	NE	NE	NE	NE	NE
Memo Items							
International Bunkers	176,02712	0,001231	0,0049	NE	NE	NE	NE
1A3a1 - International Aviation	176,02712	0,001231	0,0049	NE	NE	NE	NE
1A3d1 - International Marine (Bunkers)	NE	NE	NE	NE	NE	NE	NE
Multilateral operations	0	0	0				
CO2 emissions from biomass	2122,78401						

Inventory Year: 2020							
	HFC			PFC			SF6
Greenhouse gas source and sink categories	HFC-23 (Gg)	HFC-134 (Gg)	Other (Gg-CO2)	CF4 (Gg)	C2F6 (Gg)	Other (Gg-CO2)	SF6 (Gg)
Total National Emissions and Removals	NE	NE	24,9373126	NE	NE	NE	NE
1 - Energy							
1A - Fuel Combustion Activities							
1A1 - Energy Industries							
1A2 - Manufacturing Industries and Construction (ISIC)							
1A3 - Transport							
1A4 - Other Sectors							
1A5 - Other							
1B - Fugitive Emissions from Fuels							
1B1 - Solid Fuels							
1B2 - Oil and Natural Gas							
2 - Industrial Processes	NE	NE	24,9373126	NE	NE	NE	NE
2A - Mineral Products							
2B - Chemical Industry							
2C - Metal Production	NE	NE	NE	NE	NE	NE	NE
2D - Other Production							
2E - Production of Halocarbons and Sulphur Hexafluoride	NE	NE	NE	NE	NE	NE	NE
2F - Consumption of Halocarbons and Sulphur Hexafluoride	NE	NE	24,9373126	NE	NE	NE	NE
2G - Other (please specify)	NE	NE	NE	NE	NE	NE	NE
3 - Solvent and Other Product Use							
4 - Agriculture							
4A - Enteric Fermentation							
4B - Manure Management							
4C - Rice Cultivation							
4D - Agricultural Soils							
4E - Prescribed Burning of Savannas							
4F - Field Burning of Agricultural Residues							
4G - Other (please specify)							
5 - Land-Use Change & Forestry							
5A - Changes in Forest and Other Woody Biomass Stocks							
5B - Forest and Grassland Conversion							
5C - Abandonment of Managed Lands							
5D - CO2 Emissions and Removals from Soil							
5E - Other (please specify)							
6 - Waste							
6A - Solid Waste Disposal on Land							
6B - Wastewater Handling							
6C - Waste Incineration							
6D - Other (please specify)							
7 - Other (please specify)							

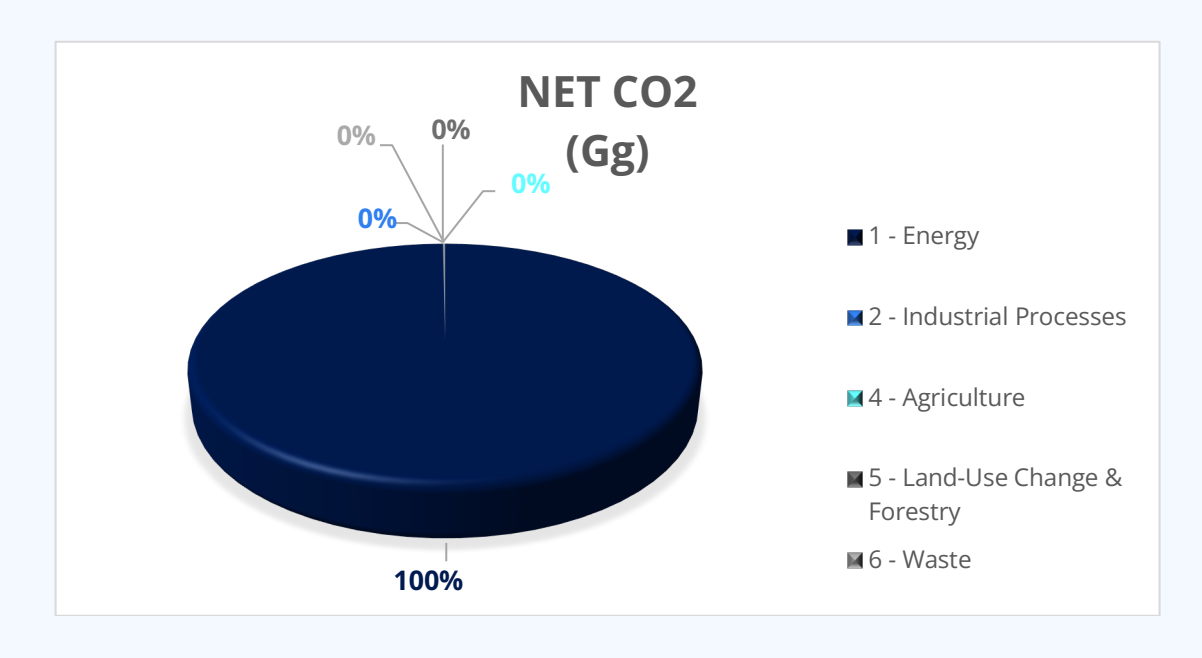
NO : Not Occuring ; NE : Not Estimate

- ***GHG emissions and removals per gas in 2020***

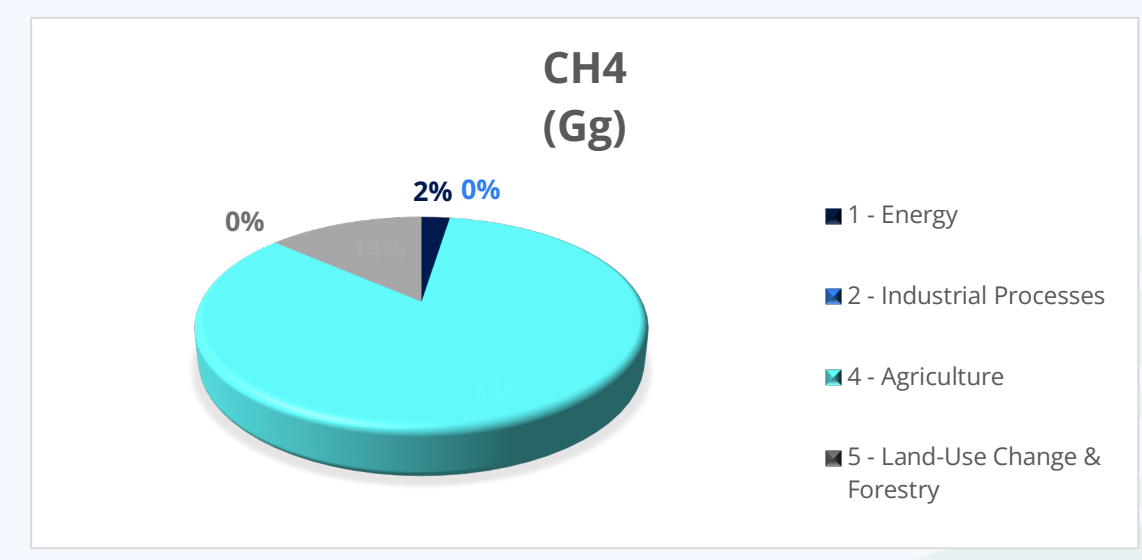
In 2020, for direct gases, global emissions are estimated at 2724.346 Gg of CO2, followed by 228.437 Gg of CH4 and finally 0.6554 Gg of N2O. Fluorinated gas emissions are estimated at 24.937 Gg CO2-e of HFCs. PFCs, SF6, other CO2 gases and other non-CO2 gases are not estimated. Indirect gas emissions estimated only fort he neergy sector amount at 24.687 Gg (NOx); 342.260 Gg (CO); 2.624 Gg (SO2) and 40.639 Gg (NMVOCs) (Figure 8).

a) Direct gas in 2020

Without FOLU, in 2020 CO2 emissions are estimated at 2724.346 Gg of which the Transport category represents 1926,190 Gg, that of Energy Industries 516,808 Gg, and that of Manufacturing Industries and construction 277,333 Gg (Figure 13). The transport category in Sierra Leone has consistently been the primary source of CO2 emissions for years. The majority of fossil fuels imported into the country are allocated to the road transport sector with a fleet of relatively old, poorly maintained vehicles.



The methane gas emissions are mainly generated from livestock category, energy and some subcategories of the Waste sectors had a considerable contribution to the country's total emissions. In 2020, the CH4 gas emissions appeared in Enteric Fermentation (3.A.1), Solid Waste Disposal (4.A), Wastewater Treatment and Discharge (4.D), and Manure Management (3.A.2) key categories.



Nitrous oxide emissions are mainly generated by Livestock, enteric fermentation subcategories and the energy sector in the absence of FOLU. There also generated to a lesser extent by Solid Waste Disposal and Wastewater Treatment and Discharge categories of the waste sector.

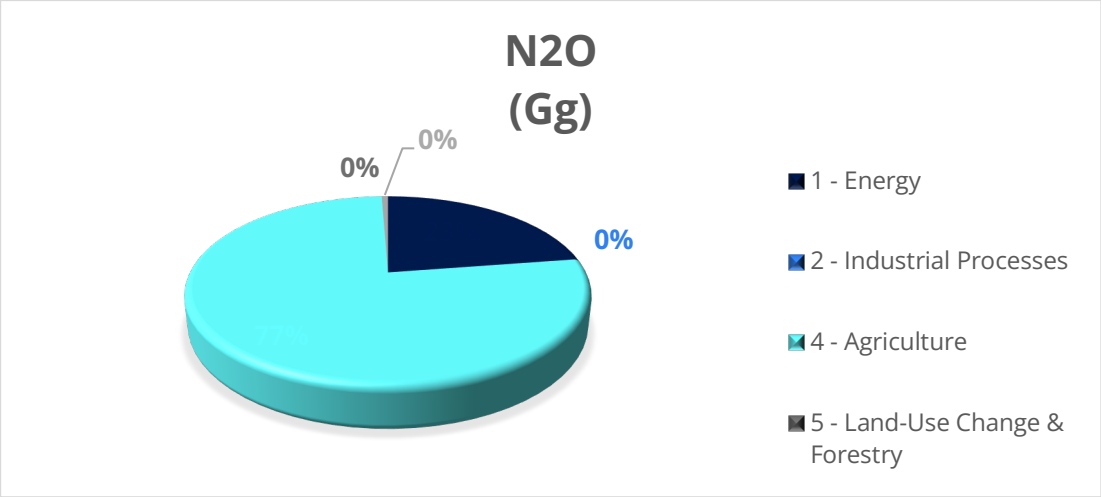


Figure 13 : Direct GHG emissions in 2020

Table 5 provides an overview of expressed direct GHG emissions in Gg CO2-e and the national total for each gas. By gas, direct GHG emissions in 2020 are distributed as follows out of a total emitted estimated at 7 727,813 Gg CO2-e:

- CO2: 2 724,436 Gg CO2-e; CH4: 4800,327 Gg CO2-e and N2O: 203,05 Gg CO2-e.

Table 5 : Total aggregate GHG emissions and removals by gas for 2020

GHG	CO2	CH4	N2O	HFCs	Total
GWP (SAR)	1	21	310	1 430	
Emissions in CO_2 eq	2 724,436	4 800,327	203,05	24,937	**7 727,813**

a) Indirect gas in 2020

Indirect gas emissions in 2020 are NOX, CO, NMVOC and SO2. NOX emissions represent a total of 21.687 Gg and are distributed as follows: 17,716 Gg coming from Transport, 2,106 Gg from the Other sectors (Commerce & Institutions and Residential), and 1,92 Gg from Manufacturing Industries and Construction.

In 2020, the road transport sector was the largest contributor to NOX emissions.

The Transport sector was the largest source of CO emissions in 2020 with 177,614 Gg. Followed by Other sectors (Commerce & Institutions and Residential) (164,256 Gg). This result can be explained by the types of combustion, mainly of biomass in households and businesses.

NMVOC emissions in 2020 are estimated at 33,376 Gg for the Transport category, and 3,164 Gg for the Others category, the rest of the relatively very low emissions account for the Energy industries and Manufacturing and Construction Industries.

In 2020, SO2 emissions are estimated 2,624 Gg mainly from Transport, and to a lesser extent from Other sectors, Energy Industries, and Manufacturing and Construction Industries. The emission levels expressed in Gg are, however, very low compared to the emissions of other indirect gases.

- **GHG emissions and removals per sector**

Estimates of emissions by category in 2020 (Figure 14) are as follows:

- Energy: CO2: 2720.331 Gg; CH4: 5,609 Gg; N2O: 0.148 Gg; NOx: 21.687 Gg; CO: 341,260 Gg; NMVOCs: 40.639 Gg; SO2: 2,624 Gg;
- Industrial Processes and Product Use: HFCs: 24,937 Gg CO2-e;
- Agriculture: CH4: 192,013 Gg; N2O: 0.503 Gg;
- Waste: CO2: 4,105 Gg; CH4: 30,966 Gg; N2O: 0.004 Gg.

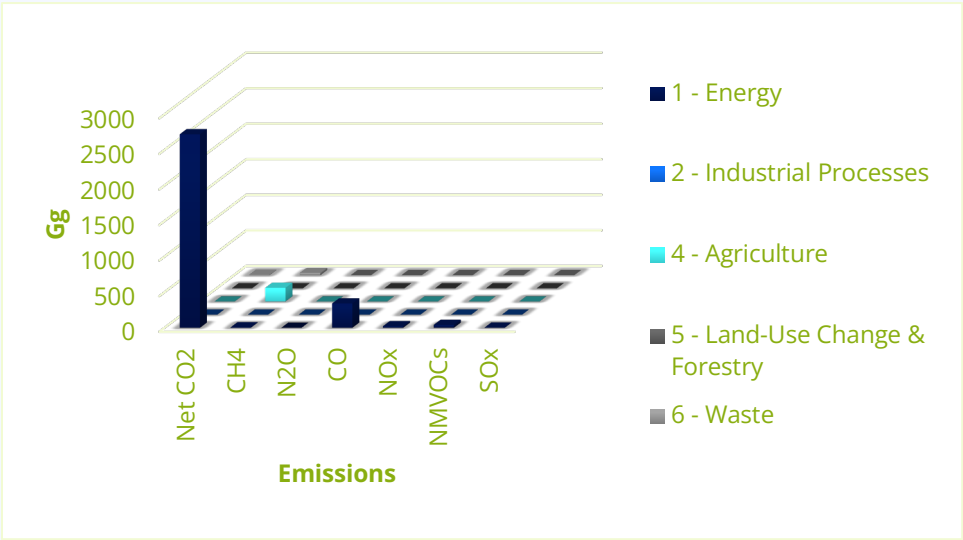


Figure 14: Total GHG emissions in 2020

3.1.4. Comparison between the sectoral and reference approach

In contrast to the sectoral approach, the Reference Approach is a relatively quick and first-order estimate of the CO2 emissions based on the fossil fuels supplied to the country. In this inventory, reference and sectoral approaches were performed independently and the results from the reference approach were used as a verification crosscheck of those from the sectoral approach.

Comparison was conducted between the sectoral and reference approaches (Table 6). Data for the sectoral approach was obtained from the Ministry of Energy and other institutions while that for the reference approach was obtained from the energy balances compiled by the International

Energy Statistics Agencies. Significant differences were obtained for all fuels. The sectoral approach reported higher figures than the reference approach.

Table 6: Comparison between the reference approach and the sectoral approach

	Reference Approach			Sectoral Approach		Difference	
Fuel	Apparent Consumption (TJ)	Apparent Consumption (excluding non-	CO2 Emissions (Gg)	Energy Consumption (TJ)	CO2 Emissions (Gg)	Energy Consumption (%)	CO2 Emissions (%)
Crude Oil	0,000	0,000	0,000			0,000	0,000
Orimulsion	0,000	0,000	0,000			0,000	0,000
Natural Gas Liquids	0,000	0,000	0,000			0,000	0,000
Motor Gasoline	4119,900	4119,900	285,509	8197,272	568,071	-49,741	-49,741
Aviation Gasoline	0,000	0,000	0,000			0,000	0,000
Jet Gasoline	0,000	0,000	0,000			0,000	0,000
Jet Kerosene	1177,470	1177,470	84,189	220,500	15,766	434,000	434,000
Other Kerosene	2969,640	2969,640	213,418	2969,640	213,517	0,000	-0,046
Shale Oil	0,000	0,000	0,000			0,000	0,000
Gas/Diesel Oil	4816,000	4816,000	356,705	12181,642	902,660	-60,465	-60,483
Residual Fuel Oil	12079,600	12079,600	934,558	12087,680	935,586	-0,067	-0,110
Liquefied Petroleum Gases	241,230	241,230	15,214	241,230	15,222	0,000	-0,053
Ethane	0,000	0,000	0,000			0,000	0,000
Naphtha	0,000	0,000	0,000			0,000	0,000
Bitumen	164,779	164,779	13,292			100,000	100,000

These discrepancies are mainly due to statistical differences resulting from the collection of data between energy supply and energy consumption in the various sectors of activity. It also reflects the insufficient consideration of the informal distribution of fuels in official statistics, especially in the transport sector. Non-energy uses of fuels such as kerosene or others were not taken into account in the sectoral method.

3.1.5. Trends in total GHG emissions from 1995 to 2020

Due to large gaps and discrepancies in activity data from one year to another, we were not able to perform time series consistency analysis.

3.1.6. Analysis of key source categories

The analysis of key categories at the national level using level assessment approach 1 reveals five (5) categories having contributed to more than 95 % of emissions in Sierra Leone. Analysis carried out without the contribution of the LULUCF sub-sector leads to the following:

1.A.3.b	CO_2	Road Transportation
4.D	CH_4	Wastewater Treatment and Discharge
1.A.1	CO_2	Energy Industries - Liquid Fuels
1.A.2	CO_2	Manufacturing Industries and Construction - Liquid Fuels
4.A	CH_4	Solid Waste Disposal.

Table 7: Key source categories in 2020

A	B	C	D	E	F	G
IPCC Category code	IPCC Category	Greenhouse gas	2020 Ex,t (Gg CO2 Eq)	|Ex,t| (Gg CO2 Eq)	Lx,t	Cumulative Total of Column F
1.A.3.b	Road Transportation - Liquid Fuels	CARBON DIOXIDE (CO2)	1902,130367	1902,130367	0,549979749	0,549979749
4.D	Wastewater Treatment and Discharge	METHANE (CH4)	560,4400083	560,4400083	0,162044968	0,712024718
1.A.1	Energy Industries - Liquid Fuels	CARBON DIOXIDE (CO2)	516,8083011	516,8083011	0,149429348	0,861454065
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CARBON DIOXIDE (CO2)	277,3329233	277,3329233	0,080187717	0,941641782
4.A	Solid Waste Disposal	METHANE (CH4)	89,84180744	89,84180744	0,025976755	0,967618537
1.A.3.b	Road Transportation - Liquid Fuels	NITROUS OXIDE (N2O)	28,0584113	28,0584113	0,008112776	0,975731313
2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	24,9373126	24,9373126	0,007210345	0,982941659
1.A.3.d	Water-borne Navigation - Liquid Fuels	CARBON DIOXIDE (CO2)	24,05965284	24,05965284	0,00695658	0,989898239
1.A.3.b	Road Transportation - Liquid Fuels	METHANE (CH4)	15,3312301	15,3312301	0,004432854	0,994331093
3.A.1	Enteric Fermentation	METHANE (CH4)	10,521273	10,521273	0,003042109	0,997373201
4.C	Incineration and Open Burning of Waste	CARBON DIOXIDE (CO2)	4,104971027	4,104971027	0,001186907	0,998560108
1.A.1	Energy Industries - Liquid Fuels	NITROUS OXIDE (N2O)	1,297251606	1,297251606	0,000375086	0,998935194
4.D	Wastewater Treatment and Discharge	NITROUS OXIDE (N2O)	1,225199856	1,225199856	0,000354253	0,999289446
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	NITROUS OXIDE (N2O)	0,696139322	0,696139322	0,000201281	0,999490727
1.A.1	Energy Industries - Liquid Fuels	METHANE (CH4)	0,439391673	0,439391673	0,000127045	0,999617773
3.A.2	Manure Management	NITROUS OXIDE (N2O)	0,427433791	0,427433791	0,000123588	0,99974136
3.A.2	Manure Management	METHANE (CH4)	0,40968984	0,40968984	0,000118457	0,999859818
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	METHANE (CH4)	0,235789125	0,235789125	6,81758E-05	0,999927993
1.A.3.d	Water-borne Navigation - Liquid Fuels	NITROUS OXIDE (N2O)	0,201308836	0,201308836	5,82062E-05	0,999986199
1.A.3.d	Water-borne Navigation - Liquid Fuels	METHANE (CH4)	0,047729676	0,047729676	1,38005E-05	1

3.1.7. Assessment of uncertainties

The evaluation of the data collected for the development of the inventories shows that in general, the uncertainties associated with the activity data are not available. To fill these gaps, the default uncertainty data recommended by the 2006 IPCC guidelines were used in the calculations.

Base year for assessment of uncertainty in trend: 1995, Year T: 2020

A	B	C	D	E	F	G	H	I	J	K	L	M
2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO2 equivalent)	Year T emissions or removals (Gg CO2 equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Type A Sensitivity (%)	Type B Sensitivity (%)	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total national emissions (%)
1.A - Fuel Combustion Activities												
1.A.1.a.i - Electricity Generation - Liquid Fuels	CO2	0	203,9232	5	6,136158302	7,91532935	0,202251541	284,0523417	284,0523417	1742,990135	2008,55337	7072301,253
1.A.1.a.i - Electricity Generation - Liquid Fuels	CH4	0	0,008256	5	228,7878788	228,842508	2,77098E-07	0,011500095	0,011500095	2,631082305	0,08137795	6,929206704
1.A.1.a.i - Electricity Generation - Liquid Fuels	N2O	0	0,0016512	5	228,7878788	228,842508	1,10839E-08	0,002300019	0,002300019	0,526216461	0,01626359	0,277168268
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	CO2	0	312,8851011	5	6,136158302	7,91532935	0,476133053	435,8294969	435,8294969	2674,318786	3081,779927	16649348,49
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	CH4	0	0,012667413	5	228,7878788	228,842508	6,52334E-07	0,017644919	0,017644919	4,036943587	0,124768418	16,31248068
1.A.1.a.ii - Combined Heat and Power Generation (CHP) - Liquid Fuels	N2O	0	0,002533483	5	228,7878788	228,842508	2,60933E-08	0,003528984	0,003528984	0,807388731	0,024953684	0,652499249
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CO2	0	277,3329233	5	6,136158302	7,91532935	0,374077359	386,3075231	386,3075231	2370,444115	2731,606692	13080680,43
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	CH4	0	0,011228054	5	228,7878788	228,842508	5,12511E-07	0,015639981	0,015639981	3,578238029	0,110591364	12,81601784
1.A.2.e - Food Processing, Beverages and Tobacco - Liquid Fuels	N2O	0	0,002245611	5	228,7878788	228,842508	2,05004E-08	0,003127996	0,003127996	0,715647622	0,022118273	0,512640737
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CO2	0	176,0271203	5	4,209124209	6,53580344	0,102749027	245,1948368	245,1948368	1032,055523	1733,789318	4071164,002
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CH4	0	0,001230959	5	100	100,124922	1,17921E-09	0,001714649	0,001714649	0,171464926	0,012124401	0,029547222
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	N2O	0	0,004923836	5	150	150,0833102	4,23928E-08	0,006858597	0,006858597	1,02878953	0,048497603	1,060759915
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CO2	0	1622,121103	5	3,068260841	7,029511101	2259,513865	2259,513865	6932,777911	15977,17576	303333554,8	
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	CH4	0	0,70119006	5	244,6927575	244,7438367	0,002286207	0,976714168	0,976714168	238,9948832	6,906412116	57166,2527
1.A.3.b.i.2 - Passenger cars without 3-way catalysts - Liquid Fuels	N2O	0	0,07598905	5	209,9375843	209,9971174	1,97674E-05	0,105848024	0,105848024	22,22147838	0,748458552	494,3542918
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CO2	0	243,3973402	5	3,415246613	6,055073032	0,168612983	339,0373653	339,0373653	1157,896214	2397,356201	7088040,395
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	CH4	0	0,01950846	5	213,3080779	213,3666705	1,34499E-06	0,027174072	0,027174072	5,79644904	0,192149705	33,63574298
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts - Liquid Fuels	N2O	0	0,0127083	5	184,3924314	184,4602091	4,2658E-07	0,017701872	0,017701872	3,264091183	0,125171136	10,66995907
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CO2	0	19,06274074	5	3,415246613	6,055073032	0,001034261	26,5532129	26,5532129	90,68577044	187,7595691	43477,56474
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	CH4	0	0,001003302	5	244,6927575	244,7438367	4,68067E-09	0,001397538	0,001397538	0,341967327	0,009882083	0,117039308
1.A.3.b.iii - Heavy-duty trucks and buses - Liquid Fuels	N2O	0	0,001003302	5	209,9375843	209,9971174	3,44596E-09	0,001397538	0,001397538	0,293395666	0,009882083	0,086178672
1.A.3.b.iv - Motorcycles - Liquid Fuels	CO2	0	17,54918339	5	3,068260841	5,86636383	0,000822759	24,4449216	24,4449216	75,0033957	172,8516983	35503,21897
1.A.3.b.iv - Motorcycles - Liquid Fuels	CH4	0	0,008356754	5	244,6927575	244,7438367	3,24728E-07	0,011640439	0,011640439	2,848331086	0,082310333	8,119764964
1.A.3.b.iv - Motorcycles - Liquid Fuels	N2O	0	0,000810352	5	209,9375843	209,9971174	2,24799E-09	0,00112877	0,00112877	0,236971223	0,007981608	0,056219067
1.A.3.b.vi - Urea-based catalysts	CO2	0	0	0	0	0	0	0	0	0	0	0
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CO2	0	24,05965284	5	4,301403713	6,595610199	0,001954831	33,51360086	33,51360086	144,1555272	236,9769443	76938,88815
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CH4	0	0,002272842	5	50	50,24937811	1,01256E-09	0,003165927	0,003165927	0,158296365	0,022386486	0,025558894
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	N2O	0	0,000649383	5	140	140,0892573	6,4244E-10	0,000904551	0,000904551	0,1266371	0,006396139	0,016077866
2.A - Mineral Industry												
2.A.1 - Cement production	CO2	0	0	78,26237921	0	78,26237921	0	0	0	0	0	0
2.A.2 - Lime production	CO2	0	0	53,85164807	0	53,85164807	0	0	0	0	0	0
2.A.3 - Glass Production	CO2	0	0	35,35533906	0	35,35533906	0	0	0	0	0	0
2.B - Chemical Industry												
2.B.1 - Ammonia Production	CO2	0	0	5	0	5	0	0	0	0	0	0
2.B.2 - Nitric Acid Production	N2O	0	0	2	0	2	0	0	0	0	0	0
2.B.3 - Adipic Acid Production	N2O	0	0	2	0	2	0	0	0	0	0	0
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production	N2O	0	0	10	0	10	0	0	0	0	0	0
2.B.6 - Titanium Dioxide Production	CO2	0	0	7,071067812	0	7,071067812	0	0	0	0	0	0
2.B.7 - Soda Ash Production	CO2	0	0	5	0	5	0	0	0	0	0	0
2.B.8.a - Methanol	CO2	0	0	14,14213562	0	14,14213562	0	0	0	0	0	0
2.B.8.a - Methanol	CH4	0	0	10	0	10	0	0	0	0	0	0
2.B.8.b - Ethylene	CO2	0	0	14,14213562	0	14,14213562	0	0	0	0	0	0
2.B.8.b - Ethylene	CH4	0	0	10	0	10	0	0	0	0	0	0
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CO2	0	0	14,14213562	0	14,14213562	0	0	0	0	0	0
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	CH4	0	0	10	0	10	0	0	0	0	0	0
2.B.8.d - Ethylene Oxide	CO2	0	0	14,14213562	0	14,14213562	0	0	0	0	0	0
2.B.8.d - Ethylene Oxide	CH4	0	0	10	0	10	0	0	0	0	0	0
2.B.8.e - Acrylonitrile	CO2	0	0	14,14213562	0	14,14213562	0	0	0	0	0	0
2.B.8.e - Acrylonitrile	CH4	0	0	10	0	10	0	0	0	0	0	0
2.B.8.f - Carbon Black	CO2	0	0	14,14213562	0	14,14213562	0	0	0	0	0	0
2.B.8.f - Carbon Black	CH4	0	0	10	0	10	0	0	0	0	0	0
2.B.9.a - By-product emissions	CHF3	0	0	14,14213562	0	14,14213562	0	0	0	0	0	0
2.C - Metal Industry												
2.C.1 - Iron and Steel Production	CO2	0	0	26,45751311	0	26,45751311	0	0	0	0	0	0
2.C.1 - Iron and Steel Production	CH4	0	0	14,14213562	0	14,14213562	0	0	0	0	0	0
2.C.2 - Ferroalloys Production	CO2	0	0	26,45751311	0	26,45751311	0	0	0	0	0	0
2.C.2 - Ferroalloys Production	CH4	0	0	10	0	10	0	0	0	0	0	0
2.C.3 - Aluminium production	CO2	0	0	22,36067977	0	22,36067977	0	0	0	0	0	0
2.C.3 - Aluminium production	CF4	0	0	10,39230485	0	10,39230485	0	0	0	0	0	0
2.C.3 - Aluminium production	C2F6	0	0	10,39230485	0	10,39230485	0	0	0	0	0	0
2.C.4 - Magnesium production	CO2	0	0	14,14213562	0	14,14213562	0	0	0	0	0	0
2.C.4 - Magnesium production	SF6	0	0	14,14213562	0	14,14213562	0	0	0	0	0	0
2.C.5 - Lead Production	CO2	0	0	10	0	10	0	0	0	0	0	0
2.C.6 - Zinc Production	CO2	0	0	10	0	10	0	0	0	0	0	0

Base year for assessment of uncertainty in trend: 1995, Year T: 2020

A	B	C	D	E	F	G	H	I	J	K	L	M
2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO2 equivalent)	Year T emissions or removals (Gg CO2 equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T	Type A Sensitivity (%)	Type B Sensitivity (%)	Uncertainty in trend in national emissions introduced by emission factor uncertainty (%)	Uncertainty in trend in national emissions introduced by activity data uncertainty (%)	Uncertainty introduced into the trend in total national emissions (%)
2.D - Non-Energy Products from Fuels and Solvent Use												
2.D.1 - Lubricant Use	CO2	0	0	10	0	10	0	0	0	0	0	0
2.D.2 - Paraffin Wax Use	CO2	0	0	10	0	10	0	0	0	0	0	0
2.E - Electronics Industry												
2.F - Product Uses as Substitutes for Ozone Depleting Substances												
2.F.1.a - Refrigeration and Stationary Air Conditioning	CH2FCF3	0,717907125	24,9373126	5	0	5	0,001206868	4915,549344	34,73612634	0	245,6215049	60329,92366
2.F.4 - Aerosols	CH2FCF3	0	0	10	10	14,14213562	0	0	0	0	0	0
2.G - Electrical Equipment												
2.G.1 - Electrical Equipment	CF4	0	0	0	0	0	0	0	0	0	0	0
2.G.1.b - Use of Electrical Equipment	CF4	0	0	30	30	42,42640687	0	0	0	0	0	0
2.G.1.b - Use of Electrical Equipment	C2F6	0	0	30	30	42,42640687	0	0	0	0	0	0
2.G.1.b - Use of Electrical Equipment	C3F8	0	0	30	30	42,42640687	0	0	0	0	0	0
2.G.1.b - Use of Electrical Equipment	C4F10	0	0	30	30	42,42640687	0	0	0	0	0	0
2.G.1.b - Use of Electrical Equipment	c-C4F8	0	0	30	30	42,42640687	0	0	0	0	0	0
2.G.1.b - Use of Electrical Equipment	n-C5F12	0	0	30	30	42,42640687	0	0	0	0	0	0
2.G.1.b - Use of Electrical Equipment	n-C6F14	0	0	30	30	42,42640687	0	0	0	0	0	0
2.G.1.b - Use of Electrical Equipment	SF6	0	0	30	30	42,42640687	0	0	0	0	0	0
2.G.1.c - Disposal of Electrical Equipment	CF4	0	0	40	40	56,56854249	0	0	0	0	0	0
2.G.1.c - Disposal of Electrical Equipment	C2F6	0	0	40	40	56,56854249	0	0	0	0	0	0
2.G.1.c - Disposal of Electrical Equipment	C3F8	0	0	40	40	56,56854249	0	0	0	0	0	0
2.G.1.c - Disposal of Electrical Equipment	C4F10	0	0	40	40	56,56854249	0	0	0	0	0	0
2.G.1.c - Disposal of Electrical Equipment	c-C4F8	0	0	40	40	56,56854249	0	0	0	0	0	0
2.G.1.c - Disposal of Electrical Equipment	n-C5F12	0	0	40	40	56,56854249	0	0	0	0	0	0
2.G.1.c - Disposal of Electrical Equipment	n-C6F14	0	0	40	40	56,56854249	0	0	0	0	0	0
2.G.1.c - Disposal of Electrical Equipment	SF6	0	0	40	40	56,56854249	0	0	0	0	0	0
3.A - Livestock												
3.A.1.a.i - Dairy Cows	CH4	0	4,938192	0	0	0	0	6,878594498	6,878594498	0	0	0
3.A.1.c - Sheep	CH4	0	2,103675	0	0	0	0	2,930288511	2,930288511	0	0	0
3.A.1.d - Goats	CH4	0	3,424785	0	0	0	0	4,77051262	4,77051262	0	0	0
3.A.1.h - Swine	CH4	0	0,054621	0	0	0	0	0,076083658	0,076083658	0	0	0
3.A.2.a.i - Dairy cows	CH4	0	0,107352	0	0	0	0	0,149534663	0,149534663	0	0	0
3.A.2.a.i - Dairy cows	N2O	0	0,427433791	0	0	0	0	0,595388702	0,595388702	0	0	0
3.A.2.c - Sheep	CH4	0	0,084147	0	0	0	0	0,117211541	0,11721154	0	0	0
3.A.2.c - Sheep	N2O	0	0	0	0	0	0	0	0	0	0	0
3.A.2.d - Goats	CH4	0	0,15069054	0	0	0	0	0,209902555	0,209902555	0	0	0
3.A.2.d - Goats	N2O	0	0	0	0	0	0	0	0	0	0	0
3.A.2.h - Swine	CH4	0	0,054621	0	0	0	0	0,076083658	0,076083658	0	0	0
3.A.2.h - Swine	N2O	0	0	0	0	0	0	0	0	0	0	0
3.A.2.i - Poultry	CH4	0	0,0128793	0	0	0	0	0,017940064	0,017940064	0	0	0
3.B - Land												
3.B.2.b.i - Forest Land converted to Cropland	CO2	0	0	20	12	23,32380758	0	0	0	0	0	0
3.C - Aggregate sources and non-CO2 emissions sources on land												
4.A - Solid Waste Disposal												
4.A.1 - Managed Waste Disposal Sites	CH4	0	35,54891661	0	0	0	0	49,51743112	49,51743112	0	0	0
4.A.2 - Unmanaged Waste Disposal Sites	CH4	0	42,65869994	0	0	0	0	59,42091734	59,42091734	0	0	0
4.A.3 - Uncategorised Waste Disposal Sites	CH4	0	11,63419089	0	0	0	0	16,20570473	16,20570473	0	0	0
4.B - Biological Treatment of Solid Waste												
4.C - Incineration and Open Burning of Waste												
4.C.2 - Open Burning of Waste	CO2	0	4,104971027	0	0	0	0	5,717969475	5,717969475	0	0	0
4.D - Wastewater Treatment and Discharge												
4.D.1 - Domestic Wastewater Treatment and Discharge	CH4	0	560,4400083	0	0	0	0	780,6580946	780,6580946	0	0	0
4.D.1 - Domestic Wastewater Treatment and Discharge	N2O	0	1,225199856	0	0	0	0	1,706627241	1,706627241	0	0	0
4.E - Other (please specify)												
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3												
5.B - Other (please specify)												
Total												
		Sum(C): 0,718	Sum(D): 3589,134				Sum(H): 8,361					Sum(M): 351569090,919
							Uncertainty in total inventory: 2,891					Trend uncertainty: 18750,176

3.1.8. QA/QC and Verification

Improving the quality of BUR1 inventories takes into account the results of QA/QC procedures in accordance with UNFCCC and IPCC guidelines. Thus, a data cross-checking mechanism is made internally and externally. Systematic reviews and audits are carried out by industry experts. This has improved the consistency, integrity, accuracy, uniformity and comparability of the inventory.

The data collected in the structures holding the data and the data collection report were validated by the experts of the sector teams on the data sources, references and documentation. Data outliers were corrected by applying data gap-filling techniques (e.g., interpolation, extrapolation) recommended by the IPCC. The quality assurance of the inventory was carried out by experts who did not participate in the compilation.

Supervisors and coordinators, in addition to external experts ensured quality control/quality assurance (QC/QA) and inventory verification procedures. The activities carried out are summarized in Table 8.

Table 8: QA/QC Activities

ACTIVITIES	PROCEDURES
QC ACTIVITIES	
Documentation	Documentation Activity data (AD) and Emission Factors (EF) collected, analyzed and compared
Calculations	Calculations on emissions/removals included
Units	Units Units used in spreadsheets
Software database	Relationships between DAs and FEs entered are checked to achieve 100% of contributions
Data consistency	Use of DA and FE tables in the software's Excel format
DATA DOCUMENTATION	
Archiving	Documentation in digital and paper format
Methodology	Sessions for analysis and verification of the temporal consistency of the data and methods used for the calculations took place between the teams' members Applications to IPCC 2006 software
Time series consistency	• Justification of trends in collected values • Adjustments made by expert judgment • Recalculations due to methodological changes
QC ACTIVITIES	
Improved DRAFTS	• Prepare DRAFT 0 for external comments • Prepare DRAFT 1 for external comments

	• Validation workshop • Integration of observations
VERIFICATION ACTIVITIES	
QA/QC checks	• Clarification of QA/QC responsibilities of inventory team members • Distribution of QA/QC checklists to inventory team members • Establishment of deadlines • Ensure completeness and accuracy of QA/QC checklists and forms • Coordination of external expertise in the inventory document
General inventory quality checks: External in-depth review, Global Support Program review	
Calculation of emissions for all GHG emission and removal categories **Documentation** **Completeness**	• Identification of parameters common to all categories: conversion factors, carbon content coefficients • Consistency check • Verification that using the same input data • Verification that the same computerized data is used as common data for all categories • Check that the number of digits or decimals of common parameters, conversion factors, emission factors or activity data is consistent for all categories • Verification that total emissions are reported consistently across all categories • Verify that emissions data is aggregated correctly from compilation at lower levels to compilation at higher levels • Check completeness for all categories and years • Verify that data gaps have been identified and communicated as intended • Comparison of estimates of the current national inventory with those of previous years
Detailed verification of the document	
General formatting **Equations**	• Verification of the following: • All acronyms and abbreviations are spelled out the first time they appear in the same chapter and are not repeated thereafter • All fonts in texts, titles and subtitles are consistent • All highlights, notes and comments in the document are removed • Bullet size, style and indentation are consistent • Spelling • Consistency of equations • The variables used in the equations

Tables et figures **References**	• The number of digits or decimals of common parameters, conversion factors, emission factors or activity data is consistent across all categories • All figures in tables agree with figures in spreadsheets • The number of digits is correct in all tables • Alignment of columns and captions • Table formatting is consistent • All figures have been updated with new data and are referenced in the text • The titles of tables and figures are accurate and consistent with the content • References are consistent and in-text citations match references

3.1.9. General assessment of the completeness

Assessments of completeness for each sector have been provided under the sector-specific description section. The general overview of completeness is as follows:

- Geographic coverage the geographic coverage is complete. The inventory covered the entire territorial boundary of the Republic of Sierra Leone. Thus, none of the administrative regions in Sierra Leone was left uncovered by the inventory.
- Sectors (sources and sinks). Except FOLU subsector for which activity data quality was very low due to gaps that could not be improved, all sources or removals of direct GHG gases, outlined in the 2006 IPCC Guidelines, were covered in the inventory. CO2 emissions and removals resulting from C stock changes in biomass, dead organic matter and mineral soils, for all managed lands, CO2 and non-CO2 emissions from the fire on all managed land, N2O emissions from all managed soils, CO2 emissions associated with liming and urea application to managed soils, CH4 emissions from rice cultivation, CO2 and N2O emissions from cultivated organic soils, CO2 and N2O emissions from managed wetlands (with a basis for methodological development for CH4 emissions from flooded land in an Appendix 3), and C stock change associated with harvested wood products were not covered.
- Gases. The majority of the direct gases have been covered under this inventory. These direct gases included CO_2, CH_4, N_2O, HFCs and PFCs (CF_4 and C_2F_6).
- Reporting activities in informal sectors. The emission inventory does not include activities that are not captured in the official data reported by the stated institution. For example, unreported fuel use, household animals that are not captured in the livestock census, unaccounted timber etc.

3.2. Energy sector

3.2.1. Brief overview of the sector

In Sierra Leone, energy sector activities that contribute directly to the emission of GHGs have been identified as electricity production, transportation, domestic consumption of energy, industrial, forestry and agricultural processes and waste generation and disposal. The emissions consist of direct GHGs from energy consumption (Carbon Dioxide (CO_2), Methane (CH_4), Nitrous Oxide (N_2O), Nitrogen Oxides (NOx), Carbon Monoxide (CO) and Non-Methane Volatile Organic Compounds (NMVOC)) and Sulphur Dioxide (SO_2).

Household lighting and Energy use are mainly dependent on batter touch light as against the use of Kerosine before the war. As electricity is partially a luxury of the big cities and towns with the bulk of the population in rural towns and villages the following chart gives a rough estimate of these facilities

All fossil fuel consumption comes from abroad. The two sub-sectors hydrocarbons and electricity are more and more solicited by the populations. The consumption of solid biofuels such as wood, wood residues and charcoal is important in the countryside and the cities of the interior of the country. The Energy sector includes two main activities related to combustion, namely:

- ***Stationary combustion:***
  - Energy industries (activities such as energy extraction, energy production and transformation, including electricity generation, oil refining, etc.);
  - Manufacturing and construction industries (iron and steel, production of non-ferrous metals, manufacture of chemicals, pulp, paper and printing, agro-food, beverages and tobacco, etc.);
  - The commercial/institutional sector (fuel combustion in commercial and institutional buildings);
  - The residential sector (lighting, cooking, heating, leisure, waste management), and
  - Agriculture/forestry/fishing (fuel combustion in agriculture, forestry, fishing and fishing industries such as fish farming).
- ***Mobile combustion linked to transport:***
  - Road transport (cars, light commercial vehicles, heavy commercial vehicles and buses, motorcycles, etc.) is the largest consumer of liquid fuels;
  - Rail transport is almost non-existent and devoted to the transport of mining products (phosphates, clinker); and
  - Air transport is mainly oriented towards the outside of the country. Internal flights are very limited and intended mainly for presidential or military missions. Due to the specific nature of these internal flights, consumption data remains confidential;
  - Inland river and maritime transport is intended for fishing activities and security patrols/services in the port area.
  -

3.2.2. Institutional system of GHGI of the Energy sector

Inventories in the Energy sector are carried out as part of the continuation of the process of compiling GHG inventories based on the achievements of the working groups and the TCNCC management system by experts led by two co-leaders.

3.2.3. GHG emissions for 2020

Energy resources and energy production encompasses all the renewable and conventional (nonrenewable) energy resources and technologies for both primary and secondary energy uses. In Sierra Leone, energy production is largely driven by the combustion of renewable resources such as biomass, and biogas and conventional resources such as petroleum-based resources. In addition referred to as liquid fuels, gaseous fuels such as methane gas, solid fuels (coal), and peat.

Direct GHGs (i.e., CO2, CH4, and N2O) and indirect GHGs such as CO, NOX, SOX, and Non-Methane Volatile Organic Compounds (NMVOC) generated during the latter processes are the main contributors to energy GHG emissions. In this inventory, following the 2006 IPCC guidelines, direct GHG and indirect GHG emissions and their sources are considered. GHG emissions are estimated based on fuel consumption in different categories and subcategories. In this inventory, energy consumptions were estimated by collecting data on fuel consumption and the physical characteristics (including calorific values and densities for data collected in volume units).

Following the 2006 IPCC guidelines (IPCC, 2006a), GHG emissions resulting from the combustion of fuels used in international transport activities referred to as international bunkers, and CO2 from biomass combustion for energy production should not be reported in national GHG emissions. They are reported under Memo and information Items, respectively. As stressed in the 2006 IPCC guidelines, all emissions from fuels used for international aviation (bunkers) and multilateral operations under the Charter of the UN are to be excluded from national totals and reported separately as memo items (Waldron et al., 2006). In Sierra Leone, GHG emissions from the international aviation source category are mainly generated by jet kerosene combustion in aircraft that operate international flights whereas CO2 from biomass combustions results from combustion activities in various categories including charcoal manufacturing, brick making, food industries, households, and public/commercial institutions (hotels, schools, restaurants, prisons, etc.).

Table 9 presents, in accordance with the recommendations of the IPCC, the summary of GHG emissions for the year 2020 according to the coded classifications of the IPCC.

Table 9: GHG emissions from the Energy sector for the year 2020

Inventory Year: 2020

Categories	Emissions (Gg)						
	CO2	CH4	N2O	NOx	CO	NMVOCs	SO2
1.A - Fuel Combustion Activities	2720,33	0,76	0,0976	21,6873	342,2596	40,64	2,624
1.A.1 - Energy Industries	516,81	0,021	0,0042	0,0453	0,112849	0,0056	0,323
1.A.2 - Manufacturing Industries and Construction	277,33	0,0112	0,0022	1,92	0,247	0,094	0,176
1.A.3 - Transport	1926,19	0,7323	0,0912	17,616	177,614	33,37	1,917
1.A.4 - Other Sectors	NE	NE	NE	2,106	164,2858	7,16	0,208
1.A.4.a - Commercial/Institutional				NE	NE	NE	NE
1.A.4.b - Residential	NE	NE	NE	2,106	164,2858	7,16	0,208
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	NE	NE	NE	NE	NE	NE	NE
1.B - Fugitive emissions from fuels	NE	NE	NE	NE	NE	NE	NE
1.B.3 - Other emissions from Energy Production	NE	NE	NE	NE	NE	NE	NE
1.C - Carbon dioxide Transport and Storage	NE	NE	NE	NE	NE	NE	NE
1.C.3 - Other				NE	NE	NE	NE

Categories	Emissions (Gg)						
	CO2	CH4	N2O	NOx	CO	NMVOCs	SO2
Memo Items (3)							
International Bunkers	176,02712	0,0012	0,0049	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers) (1)	176,02712	0,0012	0,0049	NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers) (1)				NE	NE	NE	NE
1.A.5.c - Multilateral Operations (1)(2)	NE	NE	NE	NE	NE	NE	NE
Information Items							
CO2 from Biomass Combustion	NE						
CO2 from Biomass Combustion Captured	NE						

Energy GHG emissions are related to the economic growth of any country as the main driver of the economy. This economic growth is the main reason for the increase in GHG emissions observed over the period. The increase in the Energy sector's GHG emissions could also be related to population growth, especially those generated in the residential sector.

Energy GHG emissions were estimated for 2020 on a gas-by-gas basis considering direct GHGs i.e., CO2, CH4, and N2O. Estimates of the key sources, sensitivity analysis, and uncertainty level were provided. Estimates of aggregated GHG emissions expressed in CO2 equivalent were also reported.

- **Analyses of emissions by gas**

a) Direct GHG emissions: CO_2, CH_4 and N_2O

CO2 emissions

CO2 emissions are estimated at 2720,33 Gg in 2020 in the following proportions (Figure 15): Transport 71%, Energy Industries 19%, and Manufacturing and Construction Industries 10 %.

The transport sector in Sierra Leone has consistently been the primary key source of CO2 emissions for years. The majority of fossil fuels imported into the country are allocated to the road transport sector with a fleet of relatively old, poorly maintained vehicles.

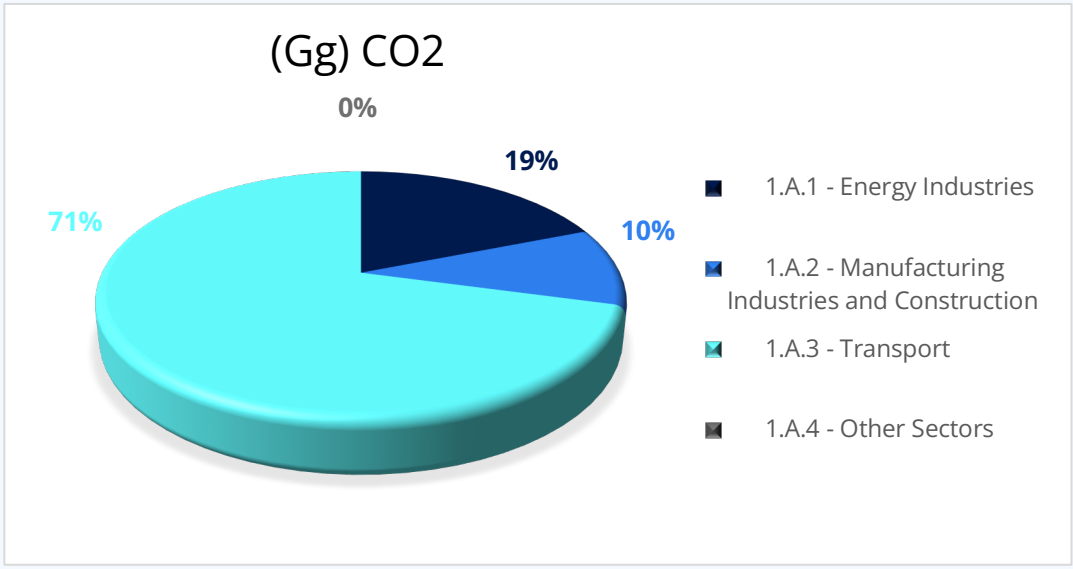


Figure 14 : CO2 emissions by category in 2020

CH4 emissions

In 2020, methane (CH4) emissions amounted to 434.87 Gg CO2-e with 86.64% of emissions coming from the Residential Commerce and Institutions category, 50.19 Gg CO2eq or 11.56% of emissions from energy industries, 7.75 Gg CO2eq or 1.78% of transport (Figure 15). The contribution of the Manufacturing and Construction Industries is negligible (0.01%).

The consumption of biomass by Sierra Leonean households is significant and represents in 2020 73.6% of final energy consumption in Sierra Leone. Combustion methods do not have good efficiency because most cooking equipment is traditional stoves

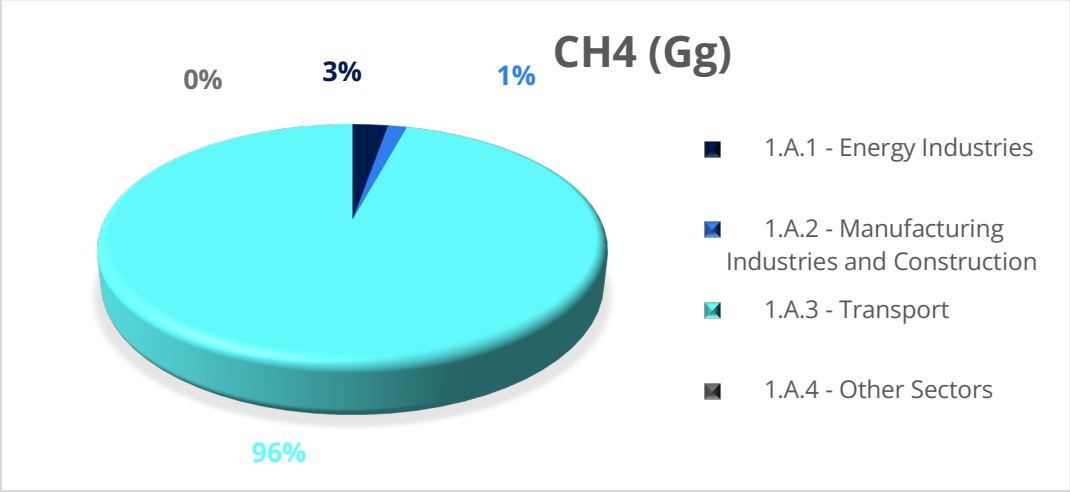


Figure 15: CH4 emissions in 2020

N2O emissions

Nitrous oxide emissions (Figure 16) are estimated at 184.76 Gg CO2eq in 2020 with 53.70%% of these emissions for the Energy Industries category 33.95% of emissions for Commerce & Institutions, 12, 24% for transport and 0.10% for Manufacturing and Construction Industries

The use of thermal electricity production to meet demand needs in 2020 is an explanation for the significant share of N2O emissions. The relatively large share of biomass in final consumption and the technology of biomass combustion in households also explain that a third of N2O emissions come from category 1A4 Other Sectors (Commerce & Institutions, Residential).

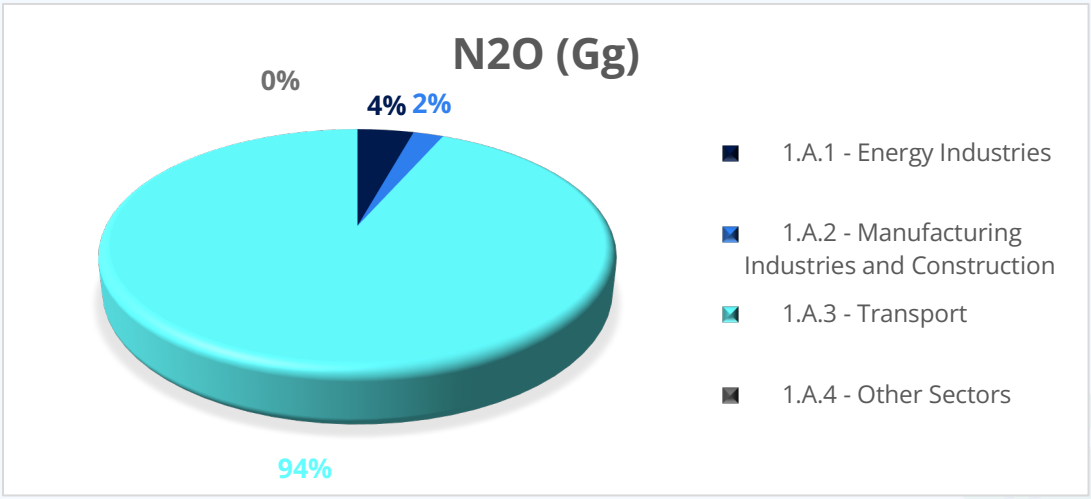


Figure 16 : N_2O Emissions in 2020

- **Analyses of emissions by category**

The emissions estimate according to categories in 2020 are as follows (Figure 17):

- Energy Industries Category: CO2: 516,81 Gg; CH4: 0,021 Gg; N2O: 0,004 Gg; NOX: 0,045 Gg, CO: 0,113 Gg; NMVOC: 0,006 Gg; SOX: 0,323 Gg
- Manufacturing and Construction Industries category: CO2: 277,33 Gg; CH4: 0,011 Gg; N2O: 0.002 Gg; NOX: 1,92 Gg CO: 0,247 Gg; NMVOC: 0,094Gg; SOX: 0,176 Gg
- Transport category: CO2: 1926,19 Gg; CH4: 0,732 Gg; N2O: 0,091 Gg; NOX: 17,616 Gg, CO: 177,614 Gg; NMVOC: 33,37 Gg and SO2 1,917 Gg.
- Residential-Commercial and Institutions category: CO2: 108.48 Gg; CH4: 17.94 Gg; N2O: 0.2 Gg; NOx: 2,106 Gg, CO: 164,286 Gg; NMVOC: 7,16 Gg and SOX: 0,208 Gg.

In the Energy Industries, Manufacturing and Construction Industries and Transport categories, CO2 emissions in Gg are the highest.

The Manufacturing and Construction Industries category contributes little to the sector's emissions of various greenhouse gases. Sierra Leone is a country in which industry has a low weight at the national level, which is reflected in the sector's emissions.

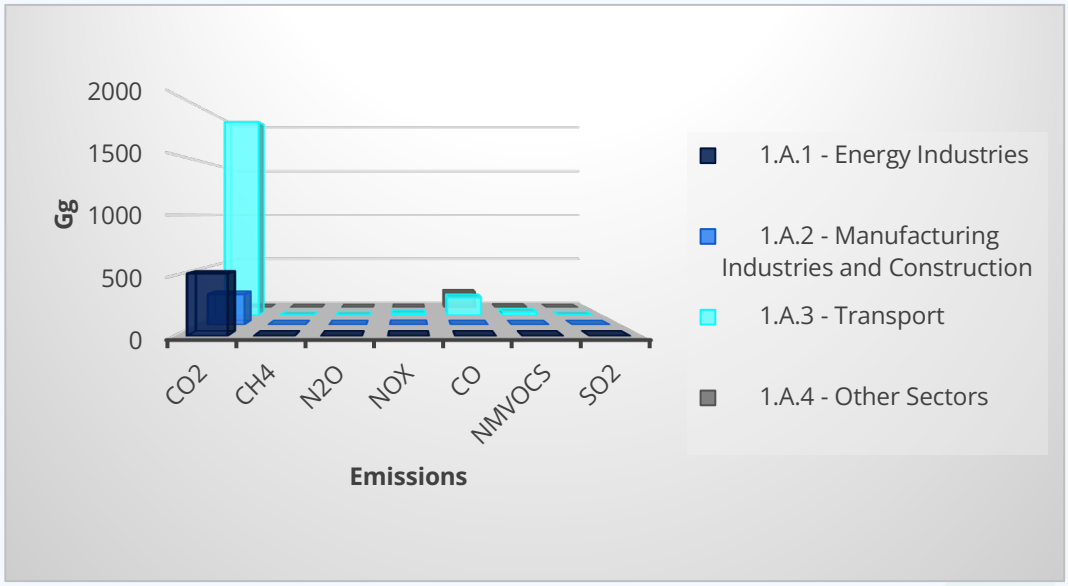


Figure 17 : Emissions by category in 2020

b) Indirect GHG emissions: CO, NOx, NMVOC and SO2

In 2020, the indirect gases emitted by the energy sector are NOX, CO, NMVOC and SOX.

NOX emissions

NOX emissions represent a total of 21,687 Gg and are distributed as follows: 81 % from Transport, 9 % from Manufacturing and Construction Industries and 10% from Energy Industries (figure 18).

The road transport sector is in 2020, the largest contributor of NOX emissions. The levels of Gg emissions from NOX (17,616 Gg) are significantly lower than the levels of CO2 (1926,19 Gg).

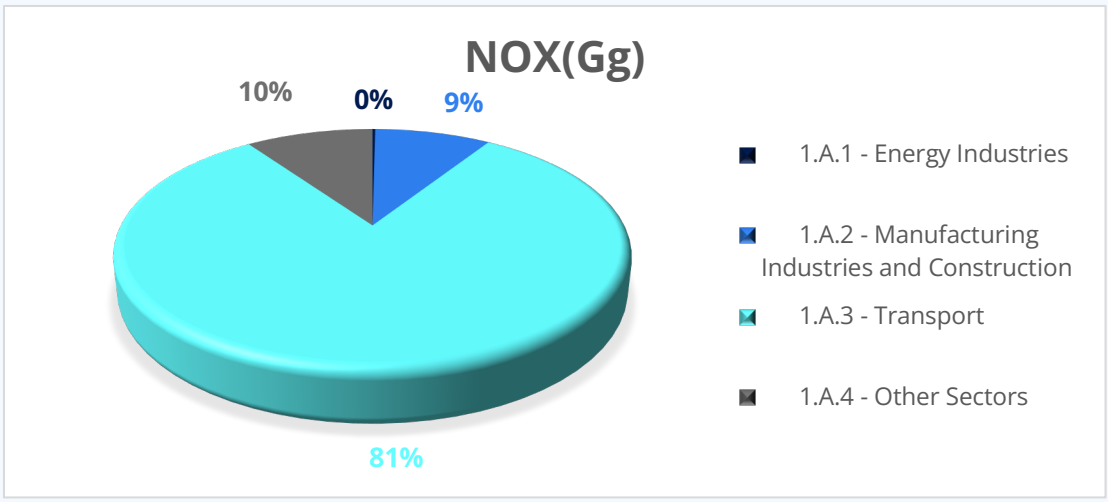


Figure 18 : NOX emissions in 2020 by category

CO emissions

CO emissions are estimated in 2020 at 658.55 Gg distributed among the categories:

- 52 % of emissions for Transport;
- 48 % of emissions for energy industries.

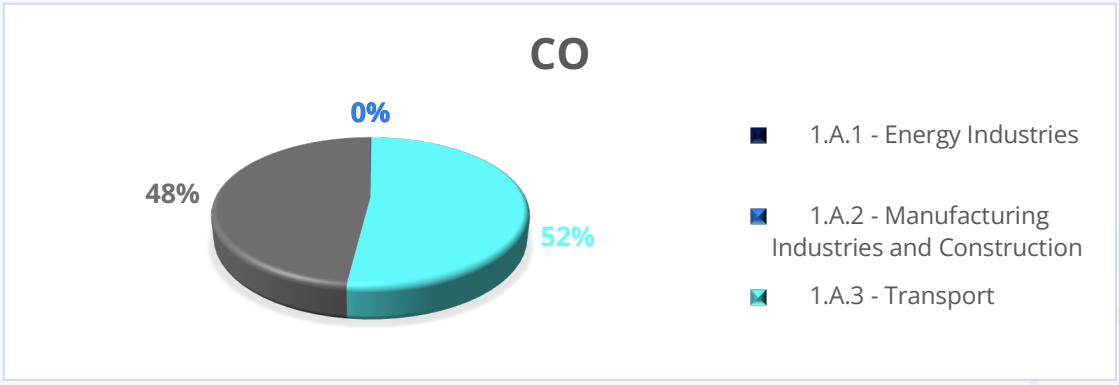


Figure 19 : CO emissions in 2020 by category

NMVOC emissions

NMVOC emissions in 2020 reached 40,64 Gg with 59 of these emissions for the Other Sectors category: 7,16 Gg, 33,37 Gg for the Transport category, the rest of the relatively very low emissions account for the Energy industries: 0,0056 Gg, and Manufacturing and Construction Industries; 0,0056 Gg.

SOX emissions

In 2020 SOX emissions are estimated at 2,624 Gg coming mainly from Other Sectors (0,208 Gg), Energy Industries (0,323 Gg), Transport (1,917 Gg) and Manufacturing and Construction Industries (0,176 Gg). The emission levels expressed in Gg are, however, very low compared to the emissions of other indirect gases.

3.2.4. Description of key source categories

A key source category is a priority category in the national inventory system since its estimate has a significant effect on a country's total direct greenhouse gas inventory, in terms of the absolute level of emissions, emissions trend, or both (IPCC, 2006).

The analysis of key sources, for the base year 2020, reveals three (3) main key sources in the Energy sector:

- Road transport;
- Energy industries (liquid fuels);
- Manufacturing and Construction Industries.

3.2.5. Assessment of completeness

The assessment of completeness was conducted according to the IPCC 2006 methodologies. All the major contributors to total GHG emissions were considered according to the IPCC 2006 guidelines. All combustion activities were considered as recommended. However, due to the lack of appropriate data, fugitive emissions were not estimated in this inventory.

3.2.6. Assessment of uncertainties

The uncertainty was estimated using the IPCC 2006 software and Tier 1 methodology was used. Default values for emission factor uncertainties were used in combination with uncertainties in the collected data. The data taken into account are the uncertainties in the activity data and the default uncertainties of the emission factors chosen in the EFDB/IPCC databases.

3.2.7. QA/QC and Verification

In this inventory, the Quality Assurance (QA) and Quality Control (QC) in both electricity generation and other energy industries activities were conducted through a comparison of collected data on fuel consumption with the data collected from different reports. In addition, the Quality Assurance

(QA) and Quality Control (QC) were implemented via a comparison of the estimates from the reference and sectoral approaches as aforementioned.

- **Quality Assurance**

The institutional arrangements are modelled on the manuals of procedures for the preparation and management of national GHG inventories of Party countries not included in Annex I to the Convention. These provisions are also based on the United States Environmental Protection Agency (EPA) GHG inventory system model.

- **Quality Control**

The fuel consumption inventory has undergone a quality and completeness check. The Statistics Division of the Directorate General for Energy supported the Energy sector team in the quality assurance of the data used.

During the establishment of this inventory of the Energy sector, the following activities were carried out:

- guarantee the integrity, accuracy and completeness of the data;
- identify and rectify errors and omissions;
- document and archive inventory material and record all QC activities.

Checks of the data collected from the institutions holding the data were carried out to ensure the accuracy of the data acquisition. The coordination of the project and the national compiler of the inventory with his team verified the correct use of the standard procedure approved by the establishment of the inventories.

3.3. Industrial processes and product use (IPPU)

3.3.1. Sector Overview

The Industrial Processes sector in Sierra Leone is relatively small, and the main GHG emissions reported are derived from the categories 2A Mineral Products (2A1 Cement production, 2A2 Lime Production, 2A3 Limestone and Dolomite Use, 2A6 Road Paving with Asphalt) and 2D Other Production (2D2 Food and Drink). Most of the categories of this sector do not occur in the country. For example, soda ash production, glass production, chemical industry, metal production, glass production and production of halocarbons and SF6 do not exist. Other categories were not estimated due to the unavailability of activity data (e.g., consumption of halocarbons and SF6).

In general, the industrial processes addressed in this sector can be grouped into two categories: mineral products and other products. This grouping is consistent with the general categorization/grouping of the Intergovernmental Panel on Climate Change (IPCC) in the Industrial sector worldwide. Minerals produced/and or used includes cement production, lime production and use, and road paving with asphalt whilst other products include beverages (beer, Guinness,

spirit and malt) and food (bread, biscuits & confectionaries). Other industrial processes are not included either because their associated activities are not practised in Sierra Leone or their activities do not involve raw material processing but rather imported materials are mixed to obtain the desired product thereby resulting in virtually no emission.

Refrigeration and air conditioning: 2F, Sierra Leone does not produce substitutes for ozone-depleting substances (HFCs and PFCs). These products are only imported and used as ODS substitutes in refrigeration and air conditioning. Sierra Leone, being a Party to the Montreal Protocol on ODS, has made a commitment to replace CFCs with HCFCs since 2013. Consumed in very small quantities, HCFC emissions in the PIUP sector are becoming a key source due to the High GWPs of these substitutes. This sector of activity is under the control of the Ozone Secretariat of Sierra Leone.

There are also artisanal activities such as artisanal metallurgical units (forges for agricultural tools and manufacturing pots and pans), textile units (manufacturing of traditional loincloths) sometimes equipped with dyeworks and agro-food units (breweries, production of wine, palm liqueur, etc.) which are sources of emission of non-methane volatile organic compounds (NMVOCs).

3.3.2. IGES Institutional system for the IPPU sector

The institutional mechanism in the IPPU sector is based on that which was put in place under the TNC and continued under the BUR1 while taking into account the lessons learned in terms of good practices to improve it. The different characteristics of this framework are:

- SL-EPA;
- Coordination of IGES;
- Industrial Processes working group

The IPPU Working Group is coordinated by Mr. Alpha Bockari and Dr. Raymond G. Johnson.

3.3.3. 2020 GHG emissions

The GHG emissions from the IPPU sector include emissions generated from 2A mineral industry, 2.C-metal industry, 2D-Non-Energy Products from Fuels and Solvent Use, and 2F-Product Use as Substitutes of Ozone-depleting substances.

Table 10 : Abridged summary of 2020 PIUP sector GHG emissions

Inventory Year: 2020								
Categories	(Gg)			CO2 Equivalents(Gg)				
	CO2	CH4	N2O	HFCs	PFCs	SF6	NF3	Other halogenated gases with CO2 equivalent conversion factors (1)
2 - Industrial Processes and Product Use	0	0	0	24,9373126	0	0	0	0
2.A - Mineral Industry	0	0	0	0	0	0	0	0
2.B - Chemical Industry	0	0	0	0	0	0	0	0
2.C - Metal Industry	0	0	0	0	0	0	0	0
2.D - Non-Energy Products from Fuels and Solvent Use (6)	0	0	0	0	0	0	0	0
2.E - Electronics Industry	0	0	0	0	0	0	0	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0	0	0	24,9373126	0	0	0	0
2.G - Other Product Manufacture and Use	0	0	0	0	0	0	0	0
2.H - Other	0	0	0	0	0	0	0	0

- **Emissions by gas**

Direct GHG emissions

Sierra Leone has cement production but does not produce clinker. As explained in the2006 IPCC Guidelines (IPCC 2006, 2006), during the production of cement, CO2 is produced in the course of the production of clinker. During this process, limestone is heated to produce lime (CaO) and CO2 as a by-product. Cement may also be made entirely from the imported clinker. In this case, the cement production process may be considered as a CO2 emissions-free process, which is the case for Sierra Leone. Thus, the production of masonry cement is considered as an emission-free process because of the addition of ground limestone to Portland cement or its clinker to produce masonry cement does not lead to additional emissions. There is no carbon dioxide emission from cement production.

Hydrofluorocarbons (HFCs) and, to a very limited extent, perfluorocarbons (PFCs), have high global warming potentials and are being used as alternatives to different classes of ozone-depleting substances (ODS) that are being phased out under the Montreal Protocol. According to the IPCC 2006 guidelines, HFCs and PFCs are being used in a variety of applications that include refrigeration and air conditioning, fire suppression and explosion protection, aerosols, solvent cleaning, foam blowing, and other applications such as equipment sterilization.

Sierra Leone neither produces nor exports substitutes for ozone-depleting substances but they are being imported mainly for refrigeration and stationary air conditioning and also Mobile air conditioning. Other applications, such as aerosols, solvent cleaning, and foam blowing are also used in Sierra Leone, however, there is a lack of data to include these sources of emissions for inventory. However, HFCs data were avaiable and could be collected from the Ozone Secretariat Website.

According to IPCC 2006, refrigeration and air-conditioning (RAC) systems can be categorized into up to six sub-application domains even though fewer sub-applications are typically used at a single country level. The following categories correspond to the sub-applications that can differ in different countries: (i) Domestic refrigeration, (ii) Commercial refrigeration including different types of equipment, from vending machines to centralized refrigeration systems in supermarkets, (iii) Industrial processes including chillers, cold storage, and industrial heat pumps used in the food,

petrochemical, and other industries, (iv) Transport refrigeration including equipment and systems used in refrigerated trucks, containers, reefers, and wagons, (v) Stationary air conditioning including air-to-air systems, heat pumps, and chillers for building and residential applications, and (vi) Mobile air-conditioning systems.

In Sierra Leone, the domestic refrigeration sub-sector is governed by R-134a refrigerant, which is used in servicing mainly stand-alone units such as freezers and fridges. Currently, the used freezers and fridges in Sierra Leone are not destroyed at the end of life but most of them are being recycled or set aside in buildings. In general, the following HFCs and HFC blends were commonly imported in Sierra Leone as ODS substitutes for the survey period 2012-2015: R134a, R404a, R 410a, R407c, and R507a

Only HFCs emissions from refrigeration and stationary air conditioning are emitted in 2020.

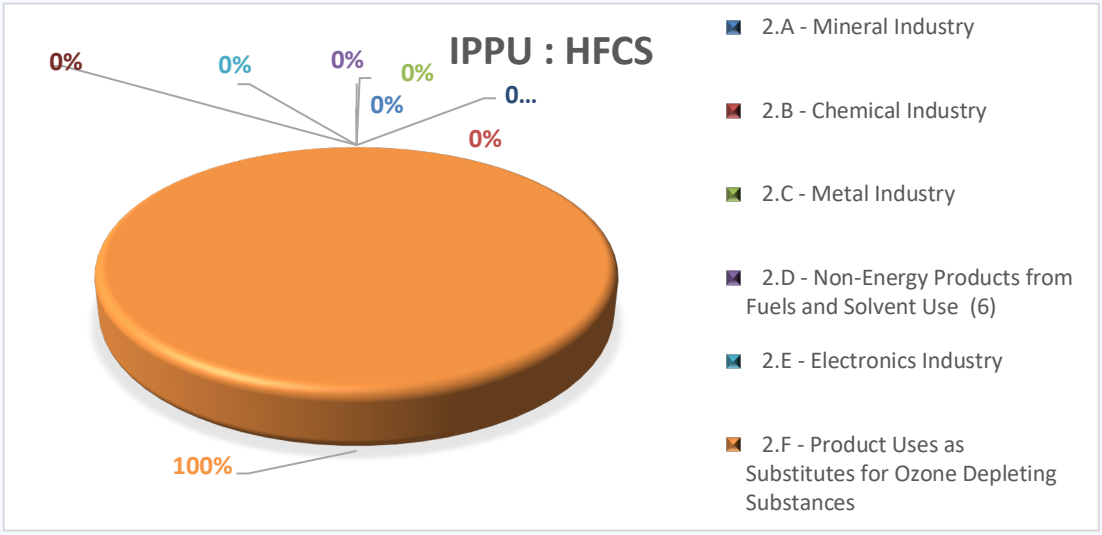


Figure 20 : Breakdown of direct GHG emissions for 2020

3.3.4. Description of key source categories

There is one key category from IPPU sector, 2F Product Uses as Substitutes for Ozone Depleting Substances, accounting for almost 100 % of the total direct GHG emissions.

3.3.5. Assessment of completeness

Completeness depends on the availability of activity data. Sierra Leone is a country without domestic solvent production. Therefore, inventory compilers may need to use expert judgement in estimating activity data, because import statistics are likely to be incomplete.

3.3.6. Assessment of uncertainties

The uncertainty from refrigeration and air-conditioning (RAC) may arise from the completeness of the chemical import where for instance interpolations from the existing data were used. In addition, it was, however, tricky to distinguish the application at each sub-application level (e.g., type of refrigerator and the HFC consumed), thus there is the uncertainty arising from the use of composite emission factors. In addition, a similar methodology has been used to estimate emissions from the different HFCs by considering the import data and the general RAC application level. Therefore, the following uncertainty ranges were considered during this study:

- Activity data uncertainties: ±10%
- Emission factor uncertainties: ±20%.

3.3.7. QA/QC and Verification

Data analysis is done internally and externally in addition to the cross-checking mechanism of data gathered at various locations. The national IGES supervisors carried out the first review of the data collected and the analysis of the inventory.

Data on the use of HFCs are taken from the Ozone Secretariat website.

3.4. Agriculture, forestry, and other land use (AFOLU)

3.4.1. Brief overview of the AFOLU sector

AFOLU sector GHG emissions and removals occur on "managed land" associated with land use, including agriculture and livestock. Managed land is land where human interventions and practices have been carried out to enable their productive, ecological or social functions (IPCC, 2006). A synthetic illustration of how land use and management can influence multiple ecosystem processes, which in turn can affect greenhouse gas fluxes, such as photosynthesis, respiration, decomposition, nitrification/denitrification, and enteric fermentation. The use of Carbon stock changes to estimate CO2 emissions and removals is based on the fact that changes in ecosystem carbon stocks occur primarily (but not exclusively) through the exchange of CO2 between the surface of land and atmosphere (other Carbon transfer processes such as leaching are assumed to be negligible). Therefore, increases in total Carbon stocks over time are equated to a net uptake of CO2 from the atmosphere, and decreases in total C stocks (minus transfers to other pools such as harvested wood products) are assimilated to a net CO2 emission. Non-CO2 emissions are largely the product of microbiological processes (i.e., in soils, animal digestive tracts and manure) and the combustion of organic matter.

The total land area in Sierra Leone is 72,300 km^2. Of this, 60,650km2 is classified as upland and 11,650km2 as lowland. It is estimated that about 53, 620km2 (5.36million ha) is suitable for crop production (i.e., 74.2% of the total area). The remaining 18, 860km2 (25.8%) of the country's land area is described as non-arable and includes rocky lands, towns and creeks (MANR/FAO, 1992).

The agriculture sector is mainly characterized by pastoral and farming activities that are now being transformed from the subsistent level to a more intensively mechanized and large scale based farming as a result of the introduction of the new agricultural commercialization policy. This increasing investments in the agricultural sector is quite likely to increase levels of production and subsequently the relative quantum of emissions of GHG from the sector, especially methane (CH4) from paddy rice cultivation, and carbon dioxide (CO2) and precursor gases (NOx, CO) from the slash and burn culture of virgin bolilands, grasslands, savannahs, forests, inland valley-and mangrove swamps and farm bush clearing.

Agriculture mainly includes pastoral and farming activities. The agriculture sector accounts for almost 40% of Sierra Leone's GDP, of which livestock and crops (not including tree crops) represent 3.15 % and 32.39 %, respectively. On a sub-sectoral basis, the contributions of crops and livestock to GDP growth of the agricultural sector were estimated at 3.02% and 0.42 %, respectively, for 2008.

Forestlands account for about 6.3m ha i.e., 87% of the total land area of Sierra Leone (UNDP/FAO-LRS 1980). The bulk of the forested area is comprised mainly of forest regrowth from shifting cultivation. It is estimated that forestry contributes about 2-4% to Sierra Leone's GDP, of which one-fourth is attributed to artisanal wood processing and export of wood-based materials. Imports of wood-based products are relatively small and erratic and constitute mostly of plywood, high-quality veneers and some sawn coniferous timbers.

3.4.2. Institutional system of GHGI of the AFOLU sector

Inventories of the AFOLU sector within the framework of the BUR1 are conducted by a team of national independent experts in the agriculture sector, forestry sector as well as land management sector.

3.4.3. 2020 GHG emissions

The emissions from different source categories and sub-categories of the AFOLU sector were estimated for the year 2020 using the 2006 IPCC guidelines with the IPCC Inventory software (version 2.871 released on August 22, 2023).

The categories and the methods were chosen based on the context of the country, the availability of data, and their disaggregation level. It should be noted that, in general, the whole AFOLU sector needs improvement from activity data to emission factors. Land use and disaggregated Land Use change data remain the greatest challenge in adequately estimating trends in GHG emissions and removals. A more complete database should be built for livestock populations by type and their characterizations, including mass (live weight), feeding habits, and other factors related to GHG emissions such as N excretion and N fraction managed in different manure management systems.

More detailed statistics on peatlands area (i.e., cultivated peatlands and peatland used for peat extraction), area of wetland crops on mineral soil, and lime application are needed to improve the agriculture subsector methodology. Fertilizer quantities used by the crop and burning on agricultural land data are also needed to complete the minimum activity data collection set. The same applies to the forestry sector where the data on all carbon pools, such as expansion factors and emission factors (EFs), have to be validated to reflect national values. Land use and Land Use change matrix going below the level of the district could facilitate the certainty of the Land Use Change detailed data.

Given the gaps, inconsistencies and significant discrepancies in available activity data for the forestry and other land uses sector, it was not possible to compile a transparent GHG inventory for the sector. Only emissions from the agriculture sector were compiled.

Table 11: Abridged summary of 2020 AFOLU sector GHG emissions

Inventory Year: 2020

Categories	(Gg)					
	Net CO2 emissions / removals	Emissions				
		CH4	N2O	NOx	CO	NMVOCs
3 - Agriculture, Forestry, and Other Land Use	NE	192,013	0,503	NE	NE	NE
3.A - Livestock	NO	192,013	0,503	NE	NE	NE
3.A.1 - Enteric Fermentation	NO	182,879	NO	NE	NE	NE
3.A.1.a - Cattle	NO	85,839	NE	NE	NE	NE
3.A.1.a.i - Dairy Cows		85,839		NE	NE	NE
3.A.1.c - Sheep		36,564		NE	NE	NE
3.A.1.d - Goats		59,527		NE	NE	NE
3.A.1.h - Swine		0,950		NE	NE	NE
3.A.2 - Manure Management (1)	NO	9,133	0,503	NE	NE	NE
3.A.2.a - Cattle	NO	1,866	0,503	NE	NE	NE
3.A.2.a.i - Dairy cows		1,866	0,503	NE	NE	NE
3.A.2.c - Sheep		1,463	0,000	NE	NE	NE
3.A.2.d - Goats		2,619	0,000	NE	NE	NE
3.A.2.h - Swine		0,950	0,000	NE	NE	NE
3.A.2.i - Poultry		2,236	0,000	NE	NE	NE
3.A.2.j - Other (please specify)		0,000	0,000	NE	NE	NE

- **Analysis of emissions gas by gas**

Direct GHG (i.e., CO2, CH4, and N2O) were mainly considered in this inventory and indirect gases such as carbon monoxide (CO) and Nitrogen oxide (NOX) were not estimated in AFOLU, mainly in the agriculture subsector.

a) Direct GHG analysis CO2, CH4 and N2O

Given the fact that the absorption of CO2 is almost zero, the emissions of non CO2 gases are distributed as follows:

- CH4: 182,879 Gg (95%): Enteric Fermentation, and Manure Management: CH4: 9,133 Gg (5%)
- N2O: 0,503 Gg (100 %): Manure Management.

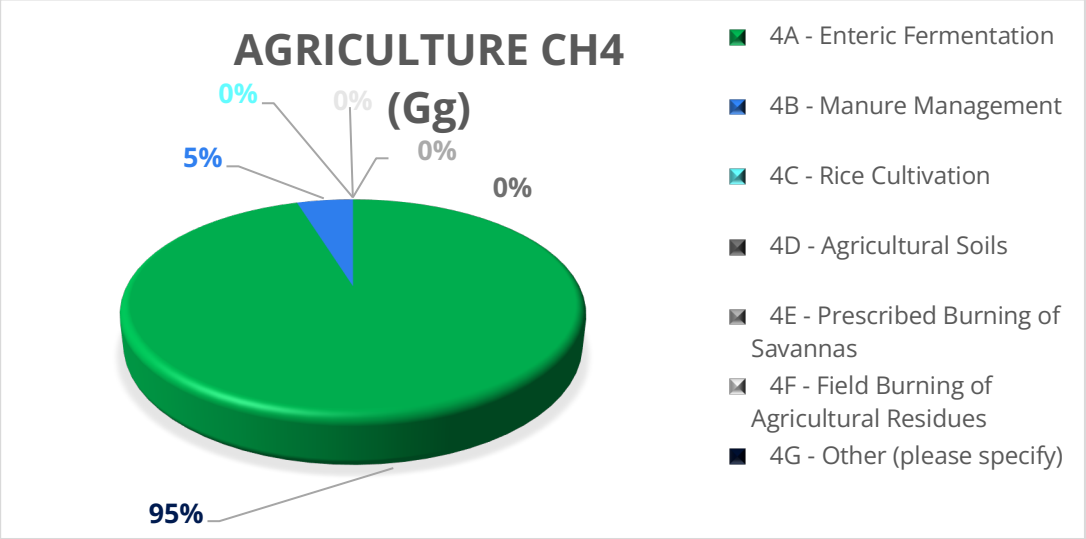


Figure 21: Contribution of the different categories to CH4 emissions for the year 2020

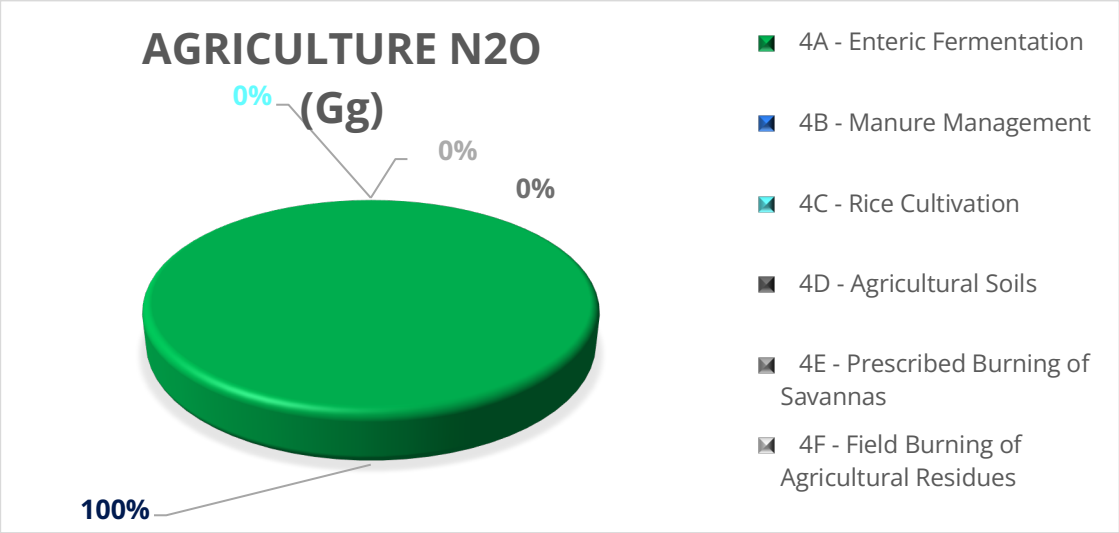


Figure 22: Contribution of the different categories to N2O emissions in 2020

- **Analysis category by category**

The analysis of the emissions by category is as follows:

- 3.A.1 - Enteric Fermentation: CH4: 182,879 Gg (95%);
- 3.A.2 - Manure Management: CH4: 9,133 Gg (5%) and N2O: 0,503 Gg (100 %).

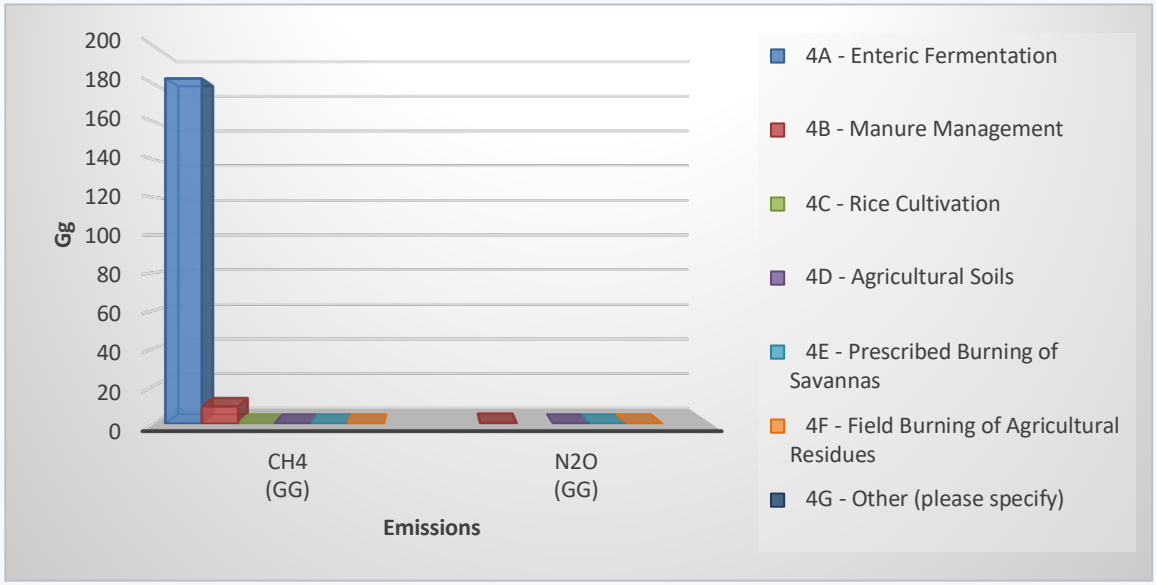


Figure 23 : Emissions by category of the Agriculture sector for the year 2020

3.4.4. Description of key source categories

Approach 1 based on level assessment identified 3 key categories:

- Enteric Fermentation (CH4);
- Manure Management: CH4; and
- Manure Management: N2O.

3.4.5. Assessment of completeness

Despite the effort made, GHG emissions from some categories and subcategories were not included in this inventory chiefly due to a lack of source data. Details on various gaps in the inventory and related data gaps are discussed in the section on planned improvements. Though reporting on precursors and indirect emissions is not mandatory for Non-Annex I countries, there is a need to consider these gases in future reports of national communication

3.4.6. Assessment of uncertainties

Uncertainty analysis identified uncertainty related to Activity data and Emission factors. The uncertainty for activity data was estimated using the default uncertainty values from the IPCC Sofware. for Enteric Fermentation from Livestock (3.A.1); Manure Management (3.A.2)

3.4.7. QA/QC and Verification

The BUR-SL has undergone a QA/QC analysis. The data collected in the structures holding the data and the data collection report have been validated. After this first phase, the data collected went through the validation phase, and the data sources, references and documentation were checked.

Quality assurance concerned the submission of the report to an external and international review, after which the short-term recommendations formulated by the review were integrated into the improved version, those in the medium and long term will be consideredin future inventories.

3.5. Waste

3.5.1. Brief overview of the sector

The waste sector comprises:

a) Solid waste disposal facilities
b) Domestic and industrial wastewater
c) Open burning
d) Incineration (industrial and medical)

Estimation of emissions in the waste sector for the IPCC looks at various waste categories such as domestic, commercial and industrial for both solid and liquid waste. This study therefore deals with the above categories considering their sub-categories. However, because of the low level of the commercial and industrial sectors in the country, waste from these sectors is of a smaller proportion compared to domestic waste.

The legal framework for waste management in the country is old, dating back to the 1970s. Despite developmental changes in population especially due to migration from rural areas to the capital Freetown during the war, municipality structure, waste types etc, the Public Health Ordinance has still not been reviewed since 1978. Until the war, Freetown has been the epitome of waste management in Sierra Leone. Notwithstanding, there have been continued changes in the institution responsible for the leadership of waste management. To illustrate, over the years, waste management in Freetown has moved from the Ministry of Health and Sanitation (MOHS) to the Freetown City Council (FCC), then the Ministry of Youth and Sports. Not too long ago, the responsibility was handed over to the FCC. Waste management was jointly managed by the Environmental Health Division (EHD) of the Ministry of Health and Sanitation, "Klin Salone (a private Non-Governmental Organization – NGO), The Freetown Solid Waste Management Company (FSWMC) and Freetown Municipal Council although only "Klin Salone" are the ones actively involved in the day-to-day collection and disposal services. This current organization of waste collection was established by FCC in 2006 with the support of GTZ and the World Bank. The FSWMC was created in the framework of an emergency Phase Operation for waste management. Presently, waste management is handled by a private company MASADA.

3.5.2. Institutional IGES mechanism for the Waste sector

The Freetown Solid Waste Management Company (FSWMC) and Freetown Municipal Council although only "Klin Salone" are the ones actively involved in the day-to-day collection and disposal services. This current organization of waste collection was established by FCC in 2006 with the support of GTZ and the World Bank. The FSWMC was created in the framework of an emergency Phase Operation for waste management. Presently, waste management is handled by a private company MASADA.

In April 2012, Sierra Leone established the environment and Social unit in Local Councils. This unit in close collaboration with the District Health Superintendent (DHS) in the Ministry of Health and Sanitation promotes proper and effective waste collection and management system. Councils collaborate with other partners like MOHS, EPA-SL, Ministries of Health and Sanitation & Lands on issues relating to the protection of the environment and waste management in particular.

3.5.3. 2020 GHG emissions

The inventory was performed at the level of IPCC categories and subcategories, from which the IPCC methods and decision trees are generally provided in the sectoral volumes. The results have been computed using either available data from various literature or by using default values provided in the IPCC 2006 guidelines.

Based on the limited availability of country-specific data, Tier 1 model has mainly been used combined with some country-specific data available to estimate emissions from waste disposal sites.

Table 12: Summary of 2020 Waste sector GHG emissions

Inventory Year: 2020							
Categories	Emissions [Gg]						
	CO2	CH4	N2O	NOx	CO	NMVOCs	SO2
4 - Waste	4,104971027	30,96580075	0,003952258	NE	NE	NE	NE
4.A - Solid Waste Disposal	0	4,278181307	0	NE	NE	NE	NE
4.A.1 - Managed Waste Disposal Sites		1,692805553		NE	NE	NE	NE
4.A.2 - Unmanaged Waste Disposal Sites		2,031366664		NE	NE	NE	NE
4.A.3 - Uncategorised Waste Disposal Sites		0,55400909		NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste		NE	NE	NE	NE	NE	NE
4.C - Incineration and Open Burning of Waste	4,104971027	NE	NE	NE	NE	NE	NE
4.C.1 - Waste Incineration	NE	NE	NE	NE	NE	NE	NE
4.C.2 - Open Burning of Waste	4,104971027	NE	NE	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge	0	26,68761944	0,003952258	NE	NE	NE	NE
4.D.1 - Domestic Wastewater Treatment and Discharge		26,68761944	0,003952258	NE	NE	NE	NE
4.D.2 - Industrial Wastewater Treatment and Discharge		NE	NE	NE	NE	NE	NE
4.E - Other (please specify)				NE	NE	NE	NE

- ***Emissions by gas***

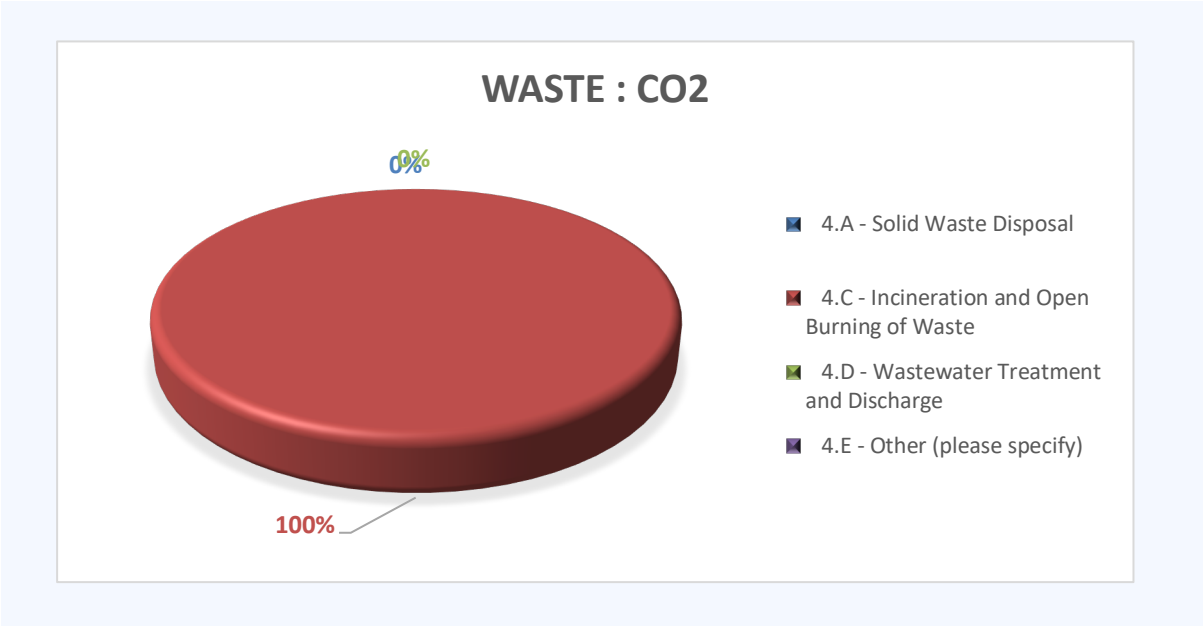
The estimated direct gases are carbon dioxide (CO2), methane (CH4), and nitrous oxide (N_2O) in 2020.

CO2 was estimated only at the level of the incineration and burning of waste in the open-air category. This estimate is 2.57 Gg. Emissions from waste incineration are calculated without energy recovery. In terms of CO2-e emissions, CO2 occupies a small proportion for the year 2020.

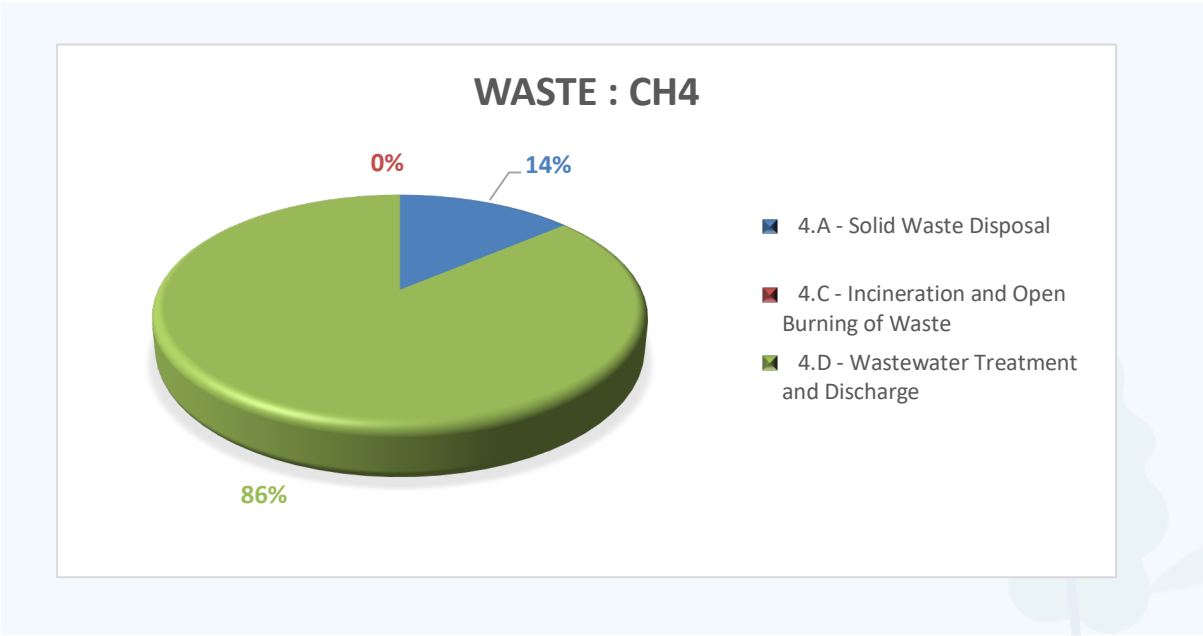
Open burning or burning of waste can be defined as the burning of combustible materials such as paper, wood, plastic, rubber, waste oils and other debris in nature (open air) or in open landfills where smoke and other emissions are released directly into the air without going through a chimney. Open burning can also be done using incineration devices that do not control the combustion air to maintain the proper temperature and do not provide sufficient residence time for complete combustion. Incineration and open burning of waste are sources of greenhouse gas

emissions, like other forms of combustion. The gases emitted are CO2, methane (CH4) and nitrous oxide (N2O).

In accordance with the 2006 IPCC Guidelines, only CO2 emissions originating from the oxidation, during incineration and open combustion of carbon from fossil waste (e.g. plastics, certain textiles, rubber, liquid solvents and used oils) are considered net emissions and should therefore be included in national CO2 emissions estimates.



The estimated methane for the year 2020 is 30,966 Gg. It comes from the categories of waste disposal (4.278 Gg), treatment and discharge of domestic and industrial wastewater (26.687 Gg).



Nitrogen hemioxide (N2O) estimated for the year 2020 is 0.003 Gg. Nitrogen hemioxide could not be estimated in the treatment and disposal of municipal, industrial and other solid waste category since it generally produces only a very small quantity of this gas.

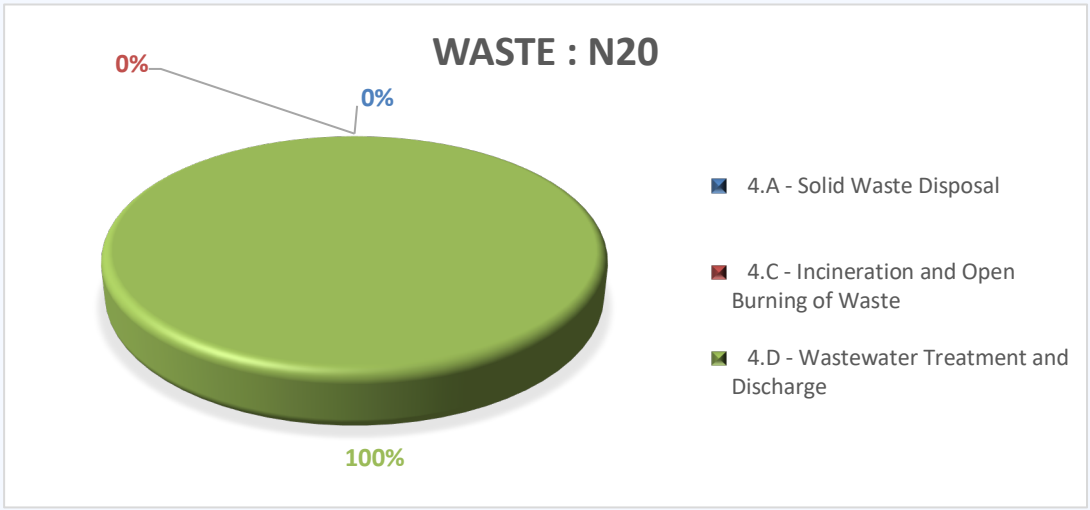


Figure 24 : Direct GHG emissions for the year 2020

The indirect gases carbon monoxide (CO), nitrogen oxides (NOx), Non-Methane Volatile Organic Compounds (NMVOCs) and sulfur dioxide (SO2) are not estimated.

- ***Emissions by category***

Disposal of solid waste (4A)

Solid waste landfilling is only carried out in large cities. Generally, this category allows the emission of non-methane volatile organic compounds (NMVOCs) as well as small quantities of nitrogen hemioxide (N2O), nitrogen oxides (NOx) and carbon monoxide (CO) but we were unable to estimate these gases given the quality of the data collected.

Biological treatment of solid waste (4B)

CH4 and N2O were not estimated in this category. The quantity of waste recycled into compost is very low in Sierra Leone despite the significant potential of biodegradable or compostable waste. This is due on the one hand to the lack of initiatives by municipalities to work for efficient and sustainable waste management and on the other hand, to a low demand for compost nationally.

Incineration and open burning of solid waste (4C)

In Sierra Leone, there is no waste incineration platform except for biomedical waste in health centres. Observation of the chimney of these incinerators shows black deposits evidence of incomplete combustion. Under these conditions, the incineration of biomedical waste is considered open burning. The gases emitted from the open combustion of waste are carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and certain indirect gases. Regarding direct gases, only emissions for CO2 are estimated to be 4.104 Gg in 2020.

The indirect gases carbon monoxide (CO), nitrogen oxides (NOx), Non-Methane Volatile Organic Compounds (NMVOCs) and sulfur dioxide (SO2) are not estimated.

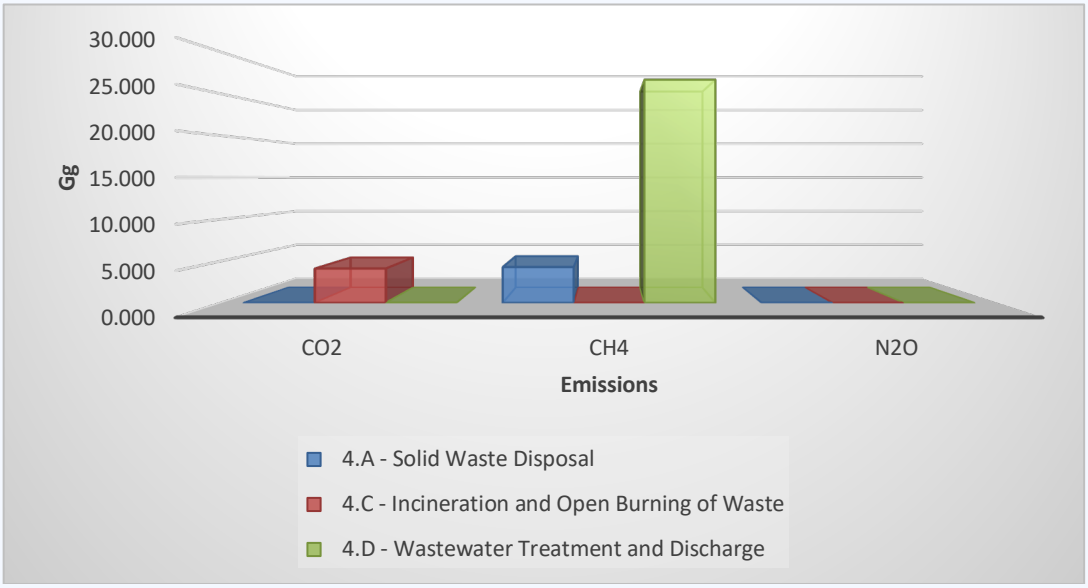


Figure 25 : Emissions by category for the year 2020

Wastewater treatment and discharge (4D)

Wastewater comes from many domestic, commercial and industrial sources. Wastewater can be a source of methane (CH4) when treated or disposed of anaerobically, as it can be a source of nitrogen hemioxide (N2O) emissions. The treatment of wastewater from most industrial units in Sierra Leone does not allow emissions of methane and nitrogen hemioxide since it is a treatment by decantation and then discharge into the sea. On the other hand, CH4 and N2O emissions from sludge and domestic wastewater are estimated in this category. Emissions are 28,688 Gg for CH4 and 0.004 Gg for N2O.

3.5.4. Description of key source categories

The waste sector in Sierra Leone presents three direct GHG emissions including CO2, CH4 and N2O. These emissions are attributable to the categories of waste disposal, biological treatment of solid waste, incineration and open combustion of waste, and treatment and discharge of wastewater. The Tier 1 method was used to identify key sources in the waste sector: 4D -CH4 Wastewater treatment and discharge; 4D- N2O Treatment and discharge of wastewater; and 4A-CH4 Disposal of solid waste.

3.5.5. Assessment of Completeness

There is often a significant contribution to emissions from other waste types. Countries should provide their own estimates of the fractions of these waste types disposed of in SWDS, incinerated or recycled. Closed SWDS continue to emit CH4. This is automatically accounted for in the FOD method because historical waste disposal data are used.

Unless sludge removal data are available, the methodology for estimating emissions from effluent is based on population and on the assumption that all nitrogen associated with consumption and

domestic use, as well as nitrogen from co-discharged industrial wastewater, will eventually enter a waterway.

The methodology does not include N2O emissions from industrial sources, except for industrial wastewater that is co-discharged with domestic wastewater into the sewer system. The N2O emissions from industrial sources are believed to be insignificant compared to emissions from domestic wastewater.

3.5.6. Uncertainty analysis

The key uncertainty is that industrial waste is collected mixed with municipal solid waste by private companies. In addition, it is assumed that all collected waste as detailed in EICV reports ends in the dumpsites.

Large uncertainties for domestic wastewater are associated with the IPCC default emission factors for N2O from effluent linked to a lack of country-specific values.

3.5.7. QA/QC and Verification

The GHG estimation was produced by making a continuous cross-check of user activity data, emission factors, and inventory results with default values provided in IPCC 2006 Guidelines and following the instructions provided on QA/QC.

In accordance with Template 3 (Description of QA/QC Procedures) and IPCC Good Practice Recommendations 2000 and the latest Guidelines 2006, Quality Assurance and Quality Control have been applied to the inventory process in the waste sector.

3.6. Data or information gaps

Waste is considered as one of the main sources of GHGs. Waste generation is one of the sectors in Sierra Leone's environmental management frameworks that is poorly regulated and coordinated, which is attributed to the absence of national and local waste management frameworks. The absence of local and national waste management frameworks and lack of waste treatment infrastructure are serious constraints and challenges in the Nationally Appropriates Mitigation Action, and limiting of greenhouse gas emissions from the waste category.

Also, other constraints and gaps that result from the continuously neglected institutional, legislative and even technical aspects which significantly affected GHG emission and climate changes may include:

i. Lack of long-term and sustainable strategic planning both at national and local levels.
ii. Unfavourable combination of energy sources (carbon-intensive fossil fuels prevail with decades)

iii. Low energy efficiency in the generation, transmission, distribution and utilization of energy with the absence of legal instruments to prevent this situation and to stimulate competitiveness through energy efficiency.
iv. Incomplete legislation for energy efficiency.

Other issues of relevance to the compilation of Sierra Leone's BUR are Financial Constraints. With regard to financial constraints, several aspects that are identified at institutional and inter-sectorial levels:

v. ***Access to capital –*** Some consumers struggle to meet the initial costs of energy efficiency measures even though they are cost-effective over time. This applies particularly to low-income households who might find it difficult to finance the initial higher cost of more efficient appliances and other energy efficiency improvements. Incentive programmes such as discounted products, and grants and loans can help overcome this. Low-income energy efficiency programs will alleviate the investment burden on vulnerable households while mitigating the need for utility subsidies. Another option would be providing dedicated loans (The European Investment Bank, EBRD) where the funds are subsequently redistributed via an intermediary financial institution through on-lending with more technical and economic expertise in the field of energy efficiency or using technical outsources. Another opportunity is utilizing the financing models based on shared savings, such as Third-party Financing and Performance Contracting.
vi. ***Weak price signals –*** Energy pricing does not yet fully reflect the environmental and economic cost of energy production and consumption. Decisions around cost-recovery pricing and incentive programmes can help overcome this barrier.
vii. ***Transactions Costs -*** In the context of energy efficiency, the costs of obtaining and interpreting information can be particularly problematic in sectors where energy is a small part of the overall budget and items are purchased primarily for attributes other than their energy characteristics. For example, when purchasing a TV consumers may be more interested in the quality and size of the picture and the look and features of the appliance rather than in the standby power consumption. Appliance labeling will help eliminate this barrier facilitating consumer choices.
viii. ***The external costs and the transparency of prices*** – The current pricing system for energy products does not create incentives for resource conservation and rational energy use. The current pricing system does not guarantee that external costs are included. Instead of an energy efficiency incentive, the current prices have been sending a market signal for uneconomical consumption. There is a lack of effort to allow consumers to understand the price of their consumption. A real-time metering system could bring down consumption.

3.7. Capacity-building needs related to GHG inventories

(i) Enhance the capacity of national sectoral experts from relevant institutions through refresher courses on the use of the UNFCCC reporting guidelines on BURs and IPCC and EMEP/EEA guidelines for calculating estimates of GHG emissions and removals on a sector-by-sector basis, including cross-cutting issues (e.g., uncertainty assessments) and on data compilation, management and maintenance and archiving of databases, with good practices in knowledge management of GHG data;

(ii) Strengthen the capacity of national sectoral experts from relevant institutions to improve methodologies and procedures for gathering relevant AD on the consumption of international aviation and marine bunker fuels;

(iii) Train the national inventory team on tools for GHG inventories, in particular the inventory software of the 2006 IPCC Guidelines, CGE training materials and relevant UNFCCC decisions;

(iv) Continuously train GHG experts, especially new experts at the national and international levels;

(v) Enhance the capacity of the national network of research institutions to conduct studies, research and assessments, focusing on improving the system for data collection needed for the development of the GHG inventory, and developing data management and archiving systems and country-specific EFs for relevant sectors (e.g., energy, IPPU and AFOLU), including to move to higher-tier estimation methodologies in the case of the most relevant key categories;

(vi) Enhance the efficiency of the implementation of the QA/QC plan and QA/QC verification activities to minimize errors, ensure better time-series consistency and enhance the accuracy and transparency of the reporting;

(vii) Enhance the national capacity of experts to develop the GHG inventory for the AFOLU sector, including the development of a land-use matrix in accordance with the requirements set out in the 2006 IPCC Guidelines (the land-use matrix might be based on information generated by a nationwide forest inventory, complemented by a complete inventory of land use of all areas, or based on data acquired through remote sensing techniques and facilitated access to the latest satellite data of land use and land-use mapping);

(viii) Strengthen the capacity of the National Ozone Unit to achieve more accurate data collection and improve methodologies and procedures for gathering relevant AD on emissions of fluorinated gases (e.g., collecting AD from companies that import, use, dispose of, recover and recycle refrigerants and refrigerant equipment in Sierra Leone).

3.8. Improvement Plans

Sierra Leone hopes to strengthen the accurate reporting of greenhouse gas emissions by undertaking the following activities:

- One of the CBIT activities is having Sierra Leone Statistics and the Sierra Leone Meteorological Agency with the EPA-SL coordination to liaise with various industries especially the Sierra Leone Brewery, Flour Mill, Cement Factory and others to source information on their production for 2020
- EPA-SL and SLMET to launch a system and database to update all activity data required for the GHG inventory on an annual basis which will significantly speed up the inventory process and should allow for annual monitoring of GHG emissions.
- National GHG Inventory Team to examine options for improving activity data used for the GHG inventory to minimise uncertainties associated with the inventories and therefore allow for more accurate estimates to be made.
- National GHG Inventory Team to consider exploring possibilities of introducing country-specific emission factors derived from detailed data on carbon contents in different batches of fuels used, or from more detailed information on the combustion technologies applied in the country, to reduce the uncertainties and the trends over time be better estimated. The Team will require capacity building to perform the aforementioned activities.
- EPA-SL to develop and sign a MoU with the Freetown City Council and other municipalities' Waste Management, Ministry of Environment, Ministry of Local Government and Ministry of Health and Sanitation to facilitate smooth data (e.g., waste generation from landfills) sharing between the and among their respective institutions.
- Development of the uncertainty management system and training of the GHG inventory team on uncertainty management.
- Conduct verification and validation meetings between main stakeholders to crosscheck inconsistencies and sources of differences, agree on land use change patterns over time and share land use maps for more harmonized use.
- Conduct GIS assessment with disaggregated data up to sector and cell levels. Land use and Land Use Change matrix going below the level of the district could facilitate the certainty of the Land Use Change detailed data.
- Determine real quantities of crop residues and manure applied over the whole season, including not just crop biomass at harvest, but in addition, weeds removed
- Conduct a survey to assess wood harvest from agroforestry trees, and GIS analysis to document agroforestry cover via maps, otherwise, available forest survey data.
- Conduct surveys to assess the extent of peat extraction and GIS data analysis from available soil data to assess the proportion of peatland and other wetlands under cropland use.
- The need for the Sierra Leone Meteorological Agency- UNFCCC Focal Point to either engage local experts or the Ministry of Lands' Surveys Unit or the EPA-SL GIS section to map out

the current land use plan since the current status in not included in the past plan/document.

- The system used for this update data collection in the Energy and AFOLU sectors are continued and extended to the other sectors in subsequent documentation.
- Future improvements should focus on developing methodologies for data collection in the Waste sector.
- Planned improvement should focus on developing methodologies for data collection in the biological treatment of the solid Waste sector.
- Improvement should consider the survey of other types of waste incinerated. In addition, there is a need to plan for the best way for the data collection on the quantity of waste incinerated at each hospital.
- Improvements should focus on improving the methodology for data collection and consider other types of industrial wastewater such as vegetables, fruits, juices, soap, detergents, etc. based on the available data.
- The activity data need to be fine-tuned so that accurate areas under the different crops can be assessed through extensive surveys and the use of accurate tools such as GIS, especially for the Land Use Change on an annual basis. Other planned improvements for the Land sector include reviewing the available data on harvested wood products and collecting activity data on disturbances.

Chapter 4: Mitigation Actions

Overview

Sierra Leone's vision on mitigation is drawn on the Low-Emission Climate-Resilience Development Strategies (LECRDS), with the objective to achieve GHG emission reductions in priority sectors through well-targeted programmes of activities and projects, including through the implementation of REDD+ (Reducing Emissions from Deforestation and Forest Degradation) programmes, which can deliver significant mitigation and adaptation co-benefits in Sierra Leone.

The various measures and options used to carry out the mitigation scenarios are contained in the various sectoral planning documents, the National Development Plan (NDP), the National Climate Change Strategy and Action Plan (NCCSAP) and in Low-Emission Climate-Resilience Development Strategies (LECRDS), the 2030 Agenda for Sustainable Development, the Vision 2020 of the Economic Community of West African States and Agenda 2063 of the African Union.

4.1. Methodologies, data and assumptions

This chapter presents the update of the information published in the recently updated Nationally Determined Contribution (NDC) concerning climate change mitigation actions and policies and their effects. The assessment was conducted in different sectors (i.e., Energy, IPPU, AFOLU and Waste) based on the guidance and UNFCCC requirements decision described in paragraphs 11-13 2(a) of UNFCCC Decision: 2/CP.17, Annex III. According to the provided guidance, Non-Annex I Parties should provide information, in a tabular format, on actions to mitigate climate change, by addressing anthropogenic emissions of all GHGs not controlled by the Montreal Protocol.

For each mitigation action or group of mitigation actions including, as appropriate, those listed in document FCCC/AWGLCA/2011/INF.1, developing country Parties should provide the following information to the extent possible:

- Name and description of the mitigation action, including information on the nature of the action, coverage (i.e., sectors and gases), quantitative goals and progress indicators.
- Information on methodologies and assumptions.
- Objectives of the action and steps taken or envisaged to achieve that action.
- Information on the progress of implementation of the mitigation actions and the underlying steps taken or envisaged, and the results achieved, such as estimated outcomes (metrics depending on the type of action) and estimated emission reductions, to the extent possible.
- Information on international market mechanisms.

To comply with these requirements, an overview of the mitigation actions previously reported in the Third National Communication (TNC) and updated in the recent NDC has been conducted to report on the previous emission reduction target as well as other non-GHG benefits, progress achieved to date and how that progress was monitored. Since the implementation period of most of the mitigation actions proposed in the recently revised NDC, the estimate of the GHG mitigation achieved for most of the mitigation actions was not estimated due to data availability and consistency.

4.2. Mitigation options

Greenhouse Gas Emission Reduction action is purposefully targeted in the Energy and AFOLU Sectors which are either the Country's main sources of GHG emissions and/or sink reduction. This growing urbanization and its inherent problem of increased waste generation cannot be over sighted though where a bird's eye view of its extent and extend as highlighted in the previous chapter will have its proposed mitigation briefly mentioned for completeness of our proposed actions.

4.2.1. Energy

Priorities for energy focus on reducing emissions from power plants and other energy fossil fuel-based sources. They are based on efforts in the sector to increase universal energy access through the deployment of renewable energy technologies and increased efficiency of energy sources. Generally, the sector could contribute immensely to emissions reduction through the implementation of the Integrated Resource Plan (IRP) developed by the MCCU and the offgrid solar energy strategy developed by the Foreign and Commonwealth Development Office (FCDO). Both documents complement actions in the sector to promote universal access to clean energy by 2030 and meet targets for emissions reduction by 2025.

In September 2014, the Energy Department of the then Ministry of Energy and Water Resources developed the" Energy Sector Strategy 2014-2017" whose vision was to "Increase Generation to 1000 MW by 2017". The bulk of this increase was geared towards the exploitation of the country's huge renewable energy potentials especially in solar and hydro energy resources as can be seen from some mentioned below.

The Ministry among others is responsible for:

- Giving Energy Policy and Direction
- Undertake a full audit of the Ministry's functions and capacities and propose changes
- Provide legal, planning and investment management technical assistance in conjunction with hiring local counterparts to develop
- Establish training curriculum and run courses on technical topics, planning, economics & project management

For the achievement of the above target the Ministry created the Electricity Generation and Transmission Company (EGTC) and Electricity Distribution and Supply Authority (EDSA) which were to focus on power generation and sale respectively. Thus, the longtime environmental concerns were now cooperated into the EGTC ACT and its accompanying Strategy and Action Plan.

The Electricity Generation and Transmission Company (EGTC) and Independent Power Producers (IPPs) sell the generated/produced electricity to EDSA based on a power purchase agreement approved by the commission. At the moment 2023, the installed generation capacity under the management of EGTC is 99.28MW, whilst the available capacity is 64.28MW nationwide. Freetown, the capital city enjoys about 87.9% of the total available capacity.

The defunct National Power Authority (NPA) was created by an Act of Parliament in 1982. It was called the Sierra Leone Electricity Corporation. The name National Power Authority was captioned in the "Supplement to the Sierra Leone Gazette Volume CXIII, Number 17, and dated 25th March 1982". NPA was described as an autonomous body that generates, transmits, distributes and supplies electricity throughout the country. The core business of NPA was to ensure the provision of safe, reliable, adequate, environmentally compliant and affordable electricity supply to its residential, commercial and industrial customers.

Because of the challenges faced by the former NPA in providing electricity services, a National Electricity Act was promulgated in 2011 by parliament which saw the unbundling of the vertically integrated NPA into two entities, that is, the Electricity Generation and Transmission Company (EGTC) and the Electricity Distribution and Supply Authority (EDSA). The functions of EDSA are:

- Be responsible for the supply, distribution and retail sale of electricity for the entire country except in areas in which the Commission has issued a distribution license to another appropriately qualified entity.
- Be responsible for dispatch and system control of electricity within its territory.
- Establish as far as is practicable uniform standard voltages throughout its area of supply
- Secure the supply of electricity at reasonable prices.
- Carry on any business usually associated with electricity distribution and supply.
- Promote and encourage the economic and efficient use of electricity, especially for domestic, commercial, agricultural, industrial and manufacturing purposes.
- Perform any other functions incidental or consequential to its functions under the 2011 Act.

It is worth noting that EDSA purchases electricity from the Electricity Generation and Transmission Company (EGTC) an Independent Power Producers (IPPs) subject to a power purchase agreement approved by the Commission responsible for regulating them.

From Sierra Leone Nationally Determined Contribution to the Paris Agreement, the three main sectors of emission reduction were the Energy, AFOLU and Waste sectors. Hence the Proposed harnessing of the country's renewable Energy sources will far outweigh its emissions not to mention the planned massive rejuvenation of its forest where the EPA and the Agriculture Ministry hope to plant 5,000000 trees in the next two years or so.

For emission reduction in the Energy sub-category of Transport, the Ministry of Transport and Aviation's "Transport Sector Development Plan" started through the provision of 50 New School Buses (with proportional yearly increase) solely for school pupils. To reduce emission, they only run to transport the school pupils to and from school quite unlike previous attempts where they were used in-between to transport the general public. The Proposed mass transportation infrastructure in the New Direction ranges from improvement in the sea transport for the coastal areas, widening the motor roads and streets to increase drive lanes, public buses in the cities and for provincial routes the introduction of traffic lights and the proposed electric rail network will greatly mitigate CO2 emissions in this sub-sector.

4.2.2. Industrial Process and Product Use

Priorities for industry focus on actions to reduce emissions from local industry and the use of various products. They are based on efforts across multiple public and private sectors to improve process and product use and enforce extended producer responsibility while reducing emissions that endanger air quality and engender persistent air pollution. The selection of mitigation options for this sector is also based on national plans to implement the Kigali Amendment to the Montreal Protocol on substances that deplete the Ozone Layer, as well as Environmental Management Plans (EMP) adopted by various producers in compliance with the Environment Protection Agency Act of 2008 (Amended in 2010).

4.2.3. Agriculture, Forestry and Other Land Uses

AFOLU cuts across sectors that contribute to land use change and land cover change for various outcomes. It focuses on the carbon impacts of forest loss, mining, and traditional agricultural practices such as slash and burn and the use of pesticides and chemical fertilizers. It also focuses on the net carbon gain of large-scale agro-investment land leases across the country, such as monoculture oil palm and sugarcane plantations run by SOCFIN and Sunbird Energy respectively. Efforts to reclaim mined-out areas or the general impacts of mining on forest carbon sequestration and soil carbon are also addressed.

4.2.4. Waste

Priorities identified for waste management reflect efforts in various sectors to effectively manage waste from agriculture, healthcare, and other practices and sources. The priorities build upon national plans for managing animal waste, general solid waste, and other hazardous substances that endanger health and ecosystem vitality

Table 13: Summary of mitigation action progress

No. of mitigation actions (Total)

No. of mitigation actions (Total)	
GHG emission reduction in total of all listed mitigation actions over a given period of time (If possible)[e]	NE

Mitigation actions by sector		
Short description of mitigation actions	Status [idea, planning phase, under implementation]	Impact [estimated GHG emission reduction, quantified in tCO_2e] over a given time[e]
Energy		
Electrification strategy by introducing renewable energies	Under implementation	NE
Implementation of energy-saving strategies	Planning phase	NE
Transport		
Improve energy efficiency in transport	Planning phase	NE
Improvement and promotion of public transport	Planning phase	NE
Industry		
Substitution of HFCs with hydrocarbon refrigerants	Under implementation	NE
Agriculture		
Improving livestock feed	Planning phase	NE
Good practices in the production of annual crops	Planning phase	NE
Use of natural inputs	Idea	NE
Improvement of rice cultivation techniques	Planning phase	NE
Forestry		
Reforestation and restoration of forest landscapes	Under implementation	NE
Support for forest conservation and restoration	Under implementation	NE
Strengthening the restoration of degraded ecosystems	Under implementation	NE

Training of FFPOs in good agroecological practices	Idea	NE
Waste		
Composting	Under implementation	NE
Best practices in Wastewater management	Idea	NE
Cross-cutting		
Technical support to apply the top-down analysis for GHG emission reduction approaches for policy makers to identify the specific/sectoral targets.	Idea	NE

4.3. Information on actions to mitigate climate change

The following information on action to mitigate climate change is drawn from the Updated Nationally Determined Contribution (NDC) of June 2021.

In order to contribute to the mitigation of global GHG emissions, Sierra Leone's commitment is to reduce its domestic GHG emissions by 10% by 2030 as compared to a no-policy scenario of 2015 to 2030, with an intermediary indicative mitigation target of 5% reduction by 2025 against the same baseline. In the longer term, Sierra Leone's mitigation ambition is to cut GHG emission by 25% in 2050 with the inclusion of additional sectors and gases in the successive NDCs with clear and measurable mitigation targets and specific actions. Depending on available financial support, Sierra Leone is committed to enhancing its mitigation efforts in accordance with the progression principle enshrined in Article 4.3 of the Paris Agreement in the light of its national circumstances.

A description of the coverage of conditional and unconditional contributions is provided below:

- Unconditional contributions include efforts to enhance sinks and reservoirs of GHG through expansion of the forest cover by planting five (5) million trees over the next five (5) years (Presidential Pronouncement, June 5, 2020), and to reduce GHG emissions through policies and measures aimed at promoting a transition to off-grid renewable energy systems, setting quality standards for improving energy efficiency, increasing access to environmentally sound waste management infrastructure, testing vehicle emissions, improving road infrastructure, and restoring mined-out areas.

- Conditional contributions include specific emissions-reduction actions, such as policies or mitigation actions like advancing a feed-in tariff for renewable energy technologies, phasing out fossil fuel subsidies, gradually converting to no-tillage agricultural practices, reducing methane emissions from wastewater and providing a nutrient-rich digestate that can be used as a fertilizer, developing incineration facilities to reduce CH4 emissions from landfill sites, investment in reuse and recycling technology, emobility and mass transportation initiatives, and new REDD+ and blue carbon initiatives.

Table 14 : Overview of actions to mitigate climate change

Name of the mitigation action	Brief description	Nature of the action (type of instrument: regulatory, economic incentive, planning, etc.)	Sector(s)	Gases	Quantitative Goals	Progress Indicators	Information on methodologies and assumptions	Objectives and steps taken or envisaged to achieve the action	Status (progress of implementation and start year of implementation)	Estimates of expected and achieved GHG emission reductions	Non-GHG mitigation (sustainable development) co-benefits	Information on international market mechanisms
Promotion of energy efficiency, enhanced management (improved transmission and distribution) and expansion of the energy mix through uptake of renewable energy sources (Solar, Wind, Hydro, Biomass) particularly in the rural areas of Sierra Leone.	Part of Efficient Residential Lighting and public lighting programs. It includes the Diagnosis, Implementation, Measurement and Verification, and Capacity Building, aimed at tackling energy efficiency projects in public buildings integrally.	Economic Incentive	Energy (energy efficiency)	5% reduction of electricity consumption in public buildings	Energy (energy efficiency)	e.g. annual emission reduction, smart meters installed, energy consumption	To calculate the estimated emission reduction, first the reduction of energy per energy source was calculated, and then an emission factor was used, corresponding to the average of the SIC and SING systems for electricity, and for natural gas, diesel or coal, IPCC tier 1 emission factors were used.	Reduction of electricity consumption in public buildings. Mains goal is the intervention of 100 buildings under the ESCO modality of contract and the installation of smart meters in 1000 buildings during the 2018-2022 period. To date, works of EE have been implemented at 39 hospitals.	Under Implementation since 2009.	An estimated 17 ktCO2eq is avoided per year for all of the 39 hospitals.	The total annual savings in fuels and electricity expenditure is estimated at USD 3.83 million, which is equivalent to 54 GWh of energy savings.	N/A
Steam generators using Nut shell												
Efficient Biomass stove using Rice husk												
Efficient Biomass stove using												

Name of the mitigation action	Brief description	Nature of the action (type of instrument: regulatory, economic incentive, planning, etc.)	Sector(s)	Gases	Quantitative Goals	Progress Indicators	Information on methodologies and assumptions	Objectives and steps taken or envisaged to achieve the action	Status (progress of implementation and start year of implementation)	Estimates of expected and achieved GHG emission reductions	Non-GHG mitigation (sustainable development) co-benefits	Information on international market mechanisms
Wood shavings & sawdust												
Enhancement of waste management systems at all levels to reduce pollution and greenhouse gas emissions under the category to improve health of both humans and animals and reduce global warming.	The ABC Plan promotes the adoption, by farmers, of a set of technologies toward increasing productivity and profitability, as well as resiliency and adaptive capacity of national agricultural systems, with the integration of soil, water and biodiversity conservation strategies	NAMA	Agriculture	CH4, N2O, CO2	Recover 15 million hectares of degraded pastures/ grazing land; increase the adoption of the no-till farming system to 8 million hectares; increase planted forests to 3.0 million hectares	Area (ha) of recovered pastures; area (ha) managed under no-till farming systems; area (ha) with planted forests; number of actions to increase the adaptive capacity of plants and productive systems	Analyses of satellite images where actions have been implemented; information collected directly from the banking sector (contracts under the financing line established by the ABC Plan); census data from the Brazilian Institute of Geography and Statistics (IBGE), the National Supply Company (Conab) and/or private companies; and surveys (field or of technical plans)	Increase the area under sustainable production systems ensuring the reduction of GHG emissions. The central action of the ABC Plan is the appropriation of information by the rural producer. The availability and accessibility of information, confidence in the technology presented, and safety in the process lead the producer to invest in transformative measures. ABC Plan activities are implemented aligned with other sectoral plans and	Implemented through 2010 to 2018	Restoration of grazing land: 83 to 104 million tCO2e by 2020; Integrated crop-livestock systems: 18 to 22 million tCO2e by 2020; Biological nitrogen fixation: 16	over 3,400 capacity building events; training of some 60 thousand producers all over the country; over BRL 16 billion passed on contracts throughout the national territory through an innovative credit line; among others	N/A

Name of the mitigation action	Brief description	Nature of the action (type of instrument: regulatory, economic incentive, planning, etc.)	Sector(s)	Gases	Quantitative Goals	Progress Indicators	Information on methodologies and assumptions	Objectives and steps taken or envisaged to achieve the action	Status (progress of implementation and start year of implementation)	Estimates of expected and achieved GHG emission reductions	Non-GHG mitigation (sustainable development) co-benefits	Information on international market mechanisms
								government actions				
Diversification of economic growth through strengthened transport sub-sector, particularly the infrastructure to contribute to the reduction of regional and global emissions of greenhouses and build a stable economy.	The project: Supporting Sierra Leone with the Shift to Electric Mobility is a four-year project that hopes to provide the building block for the gradual shift Electric Mobility. It will provide necessary legislation for all types of E-Mobility from Electric cars, buses, trains etc.	NAMA	Transport	CO2	To reduce the emission from the Transport sector through the non-use of Fossil fuel that conventional transports use.	Amount of Fuel reduction that results in the use of the 15 Pilot\ E-Kekes	The methodology of the project is to work with the current Transport Providers and the transport Operators for the gradual introduction of E-Mobility (E-Kekes or Three Wheelers). During its development, the series of E-Mobility Experts (National/International) shall work with relevant stakeholders to formulate necessary policy/regulation together with the necessary Gender Sensitive strategy for E-mobility. It is assumed that the high cost of fossil fuel and Sierra Leone's	The project objective is: To mitigate GHG emissions in Sierra Leone by accelerating the introduction of electric mobility through the development of legal, regulatory and institutional framework, capacity building, demonstration pilots of electric vehicles, development of business models for private sector engagement and finance schemes for up scaling and replication. The introduction of 15 E-Kekes in the transport market will encourage others to follow and gradually include other forms of	The Project is in its Second Year and at the stage for the development of an E-Mobility Strategy and legislation.	15,000 tons of CO2	Job Creation for the young men and women that will be driving the E-Kekes. Reduction of crime rate that unemployment is known to cause.	The importation of the new E-Mobility transportation will foster international trade and the accrued carbon credit resulting will bust the Sierra Leone economy

Name of the mitigation action	Brief description	Nature of the action (type of instrument: regulatory, economic incentive, planning, etc.)	Sector(s)	Gases	Quantitative Goals	Progress Indicators	Information on methodologies and assumptions	Objectives and steps taken or envisaged to achieve the action	Status (progress of implementation and start year of implementation)	Estimates of expected and achieved GHG emission reductions	Non-GHG mitigation (sustainable development) co-benefits	Information on international market mechanisms
							increasing access to sustainable electricity will aggravate the shift to e-mobility	transports ranging from E-Cars, E-Buses to E-Trains.				
Strengthening the Environment Protection Agency to institutionalize the monitoring, reporting and verification of climate change.	Capacity Building Initiative for Transparency (CBIT)	Capacity Building	MRV	NA	To adequately build Sierra Leone's Capacity (>70%) for the implementation of the MRV component of the Paris Agreement of the UNFCCC	Just started during the last quarter of 2022	Working with Stakeholder Ministries, Departments and Agencies (MDAs) and other relevant other organisations, the national standards in conformity to the IPCC 2006 Guidelies are developer. Necessary Logistics like computers are provided to stakeholders for the enhancement of their work.	To build the Capacity of National Institutions and relevant stakeholders for their enhancement MRV Capacity for the Paris Agreement	The engagement with stakeholders and the needed capacity training on the MRV is ongoing	Non-quantifiable	The capacity enhancement of non-state actors that the National MRV MDAs will be training for the proper implementation of the Paris Agreement.	The knowledge on the various market-based mechanism of the Pasris Agreemet by stakeholders
Promoting energy efficiency and diversifying the energy mix through renewable energy sources	Sierra Leone Rural Mini/off-Grid Electrification Project	NAMA	Energy	CO_2	It aims to empower the rural community to access energy for their domestic and	The Rural Solar mini-grid electrification of 50 chiefdom Headquarter	The above project is only in about 30% of the chiefdom headquarter towns. There is need for its	The programme will scale up this access to energy in those communities mentioned above that are not	80% done and expected to be completed soon	4Mega Watt of electricity production is reduced from current fossil fuel usage	Job Creation got the youths. Provision of added value to agricultural production through	

Name of the mitigation action	Brief description	Nature of the action (type of instrument: regulatory, economic incentive, planning, etc.)	Sector(s)	Gases	Quantitative Goals	Progress Indicators	Information on methodologies and assumptions	Objectives and steps taken or envisaged to achieve the action	Status (progress of implementation and start year of implementation)	Estimates of expected and achieved GHG emission reductions	Non-GHG mitigation (sustainable development) co-benefits	Information on international market mechanisms
					livelihood activities. As most of the rural population are farmers and traders, the availability of energy will help in both the processing and preservation of their agricultural product.	towns in Sierra Leone	expansion to other chiefdom headquarter towns. Moreover, some towns are bigger than some chiefdoms headquarter towns. It is therefore envisaged that the programme be extended to all the rural town that is larger than the smallest chiefdom headquarters town. In this way, it will adequately serve the rural agricultural communities.	covered by the existing programme. This will benefit the grater agricultural communities of all chiefdoms in Sierra Leone's Rural settlements.			refrigeration and processing, improving trade like sale of softdrinks and water/beers etc	
Adopting climate- smart and conservation agriculture	Boosting Agriculture and Food Security Project	NAMA	Agriculture	CH_4. N_2O and CO_2	Boosting Agriculture and Food Security Project through the production increasev of more than 50%	The increase in food availability and reduction in the importation of the types of food grown	It will build on the present agricultural researches done to intensify the shift from tranditional farming practices to mechanical agriculture.	It enhances the availability of food and increases huge savings in the foreign that was used to import similar food. Need for its scale-up by the AAI readiness	Ongoing with the formulation of necessary agricultural development policy and regulation formulation	140 -500,000 tonnes of CO_2 equivalent	Food Security and job creation for unemployed youths	

Name of the mitigation action	Brief description	Nature of the action (type of instrument: regulatory, economic incentive, planning, etc.)	Sector(s)	Gases	Quantitative Goals	Progress Indicators	Information on methodologies and assumptions	Objectives and steps taken or envisaged to achieve the action	Status (progress of implementation and start year of implementation)	Estimates of expected and achieved GHG emission reductions	Non-GHG mitigation (sustainable development) co-benefits	Information on international market mechanisms
Support the establishment of adequate weather stations around the country to provide reliable and adequate weather data that will be useful to properly inform farmers.	The enhancement of Climate Services provision by the Sierra Leone Meteorological Agency	Capacity Building	NAP	NA	To establish some 10 weather observation stations and install the relevant CLICOM data processing facilities for climate services	The existence of functional climate stations and data processing centres	The approximately equally space weather observation stations together with a central real-time CLIMAT Data Processing centre	The Climate Services PIF prepared and awaiting funding approval from the Global Framework for Climate Services (GCFS)	2024	NA	Enhanced service delivery of Meteorological /Climatological services to stakeholders	

4.4. Any other information on mitigation actions

Sierra Leone has participated in recent years in projects involving international market mechanisms (such as CDM projects). In the database of CDM projects of the UNFCCC (https://cdm.unfccc.int/Projects/projsearch.html) a project hosted by Sierra Leone called *Project 9556: Makeni power project* (https://cdm.unfccc.int/Projects/DB/RWTUV1359583902.25/view) is mentioned.

In addition, Sierra Leone is involved in the negotiation process with regard to the New market mechanisms under Article 6 of the Paris Agreement (6.2, 6.4 and 6.8).

4.4.1. Progress of Mitigation Actions and their Effects

It is common knowledge that GHG Mitigation mostly affects national socio-economic policies and its accompanying developmental choices/pathways taken into consideration, its sustainability and equity. It is against this backdrop that Sierra Leone's policies to limit net emissions to promote sustainable development are consistent with the broader it's societal objectives. The Sierra Leone NAMA documentation captured some seven strategies for the holistic approach to addressing Climate Change. However, for the reduction of GHG emissions, the following strategies were proposed for action pending the availability of necessary enabling resources since the government support was overwhelming from current Cluster 7 of the 2019-24

4.4.2. Mitigation strategy

The strategy for implementing mitigation measures is made up of three main required components: mitigation goals, mitigation actions, and an action plan for implementation. These provide a framework to identify, prioritize and implement actions to reduce climate risks and vulnerabilities.

The mitigation strategy fully takes account of gaps and achievements made with the implementation of mitigation measures since 2015, when the INDC of Sierra Leone was elaborated before COP21 to the UNFCCC where the Paris Agreement has been adopted.

Table 15 : Climate mitigation progress since 2015

Strategy	Associated Priority Sector (s)	Progress made (2015 to date)
Institutionalization of coordination, monitoring, reporting and verification of climate change issues by strengthening the Environment Protection Agency for effective and efficient provision of technical policy advice to the Government and people of Sierra Leone for relevant	All sectors	• An inter-ministerial committee was established for environmental and climate change coordination. • A national climate change standing committee was established in 2016 to coordinate climate change actions at national level

decision-making in transitioning to green economic growth.		• Regional climate change committees established in 2020 for regional-level coordination.
Transformation of the National Meteorological Services of Sierra Leone and strengthening of the Climate Change Early Warning System of Sierra Leone	All Sectors	• Sierra Leone Meteorological Agency Act of 2017 (Act No.64) passed • The Sierra Leone Meteorological Department transformed into an Agency in 2017
Promotion of energy efficiency, enhanced management and expansion of the energy mix through uptake of renewable energy sources (Solar, Wind, Hydro, Biomass) particularly in the rural areas of Sierra Leone.	Energy	• National Renewable Energy policy developed in 2016 and updated in 2020 • Energy Efficiency policy developed in 2016 • National Clean Cooking Action Strategy and Action Plan developed in 2020
Enhancement of waste management systems at all levels to reduce pollution and greenhouse gas emissions under the category to improve the health of both humans and animals and reduce global warming.	Waste	• Municipal solid waste collection is enhanced through various youth-led schemes • Funding secured for the establishment of a landfill site in the capital
Diversification of economic growth through strengthened transport sub-sector, particularly the infrastructure to contribute to the reduction of regional and global emissions of greenhouses and build a stable economy.	Transport	• An Integrated and Resilient Urban Mobility Project is being implemented to mainstream climate change into various infrastructural development initiatives
Adoption and application of climate-smart and conservation agriculture through best agricultural practices that enhance soil fertility and improve crop yield	AFOLU	• 8,500ha of forest trees planted by Miro Forestry • The President recently launched the 5 million tree initiative to be completed in the next 4years (1.1 million trees already planted) • Developed and implemented the Voluntary Guideline on the responsible governance of tenure of land fisheries and forest in the context of national food security

Based on the analysis above, the following gaps have been identified:

- Most of the strategies lacked concrete actions and targets, linked partly to a lack of institutional capacity. This is gradually changing with the growing appetite for climate mitigation by both public and private entities;
- There are capacity gaps in project design for climate change mitigation, hence the low delivery on some of the proposals made previously
- Limited data and research capacity of the country to support implementation and monitoring of mitigation actions.

To fill gaps, this NDC proposes the following mitigation actions, to be implemented by 2025 (initial timeline for reviewing the NDC, and 2030 (end line for achieving measures proposed for

mitigation). Table 7 below proposes an action plan with timelines, responsibilities, and costs, as well as a sense of how mitigation actions will be prioritised for implementation.

a) **Development plan and its predecessors**.

- **Strategy 1:** Promotion of energy efficiency, enhanced management (improved transmission and distribution) and expansion of the energy mix through uptake of renewable energy sources (Solar, Wind, Hydro, Biomass) particularly in the rural areas of Sierra Leone.
- **Strategy 2:** Enhancement of waste management systems at all levels to reduce pollution and greenhouse gas emissions under the category to improve health of both humans and animals and reduce global warming.
- **Strategy 3:** Diversification of economic growth through strengthened transport sub-sector, particularly the infrastructure to contribute to the reduction of regional and global emissions of greenhouses and build a stable economy.
- Adoption and application of climate-smart and conservation agriculture that allow minimum disturbance and year-round maintenance of soil and soil cover, including the use of leguminous crops to boost soil nitrogen; adoption of new crops, crop rotation and/or crop varieties and adjusting the time of planting/harvesting; introduction of integrated soil-fertility management systems that cater to the nutritional needs of the crop without polluting the environment; and integrated water management practices were recommended together with massive tree planting

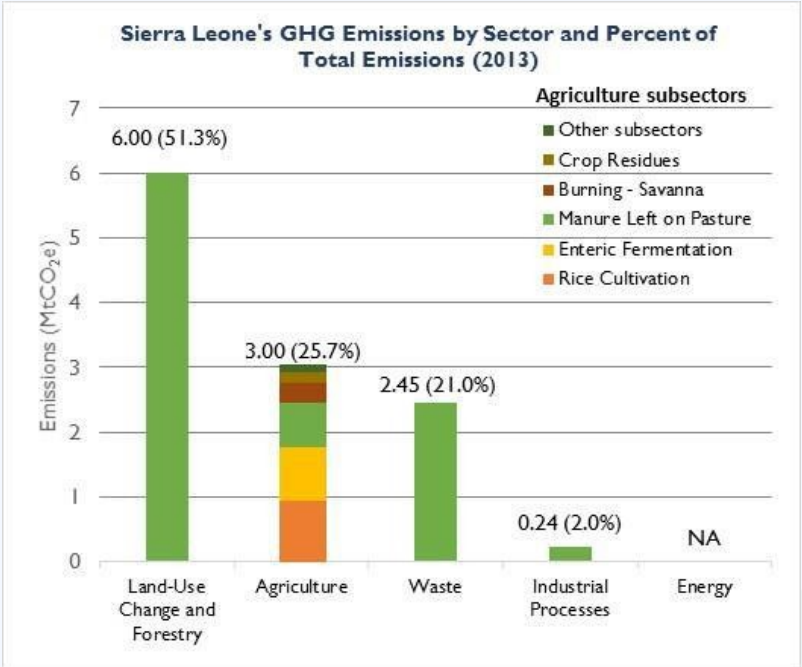


Figure 26 : Sierra Leone's GHG Emissions by Sector and Percentage total Emissions Sources: WRI CAIT 2.0, 2017, FAOSTAT, 2017.

b) National Mitigation Action

In its Intended Nationally Determined Contribution (INDC), Sierra Leone discusses a conditional target or "desired outcome" whereby it intends to maintain its relatively low emission levels (defined as close to the world average of 7.58 MtCO2e) by 2035 or to be carbon neutral by 2050 by reducing its carbon footprint and following green growth pathways in all economic sectors. This outcome hinges on the receipt of international support. The INDC identifies several priority climate change mitigation strategies, including:

1) Strengthening the Environment Protection Agency to institutionalize the monitoring, reporting and verification of climate change.
2) Promoting energy efficiency and diversifying the energy mix through renewable energy sources.
3) Enhancing waste management systems
4) Strengthening transport infrastructure, and (5) adopting climate-smart and conservation agriculture.

In the LUCF sector, the INDC notes that there is significant uncertainty in the business-as-usual scenario and mitigation potential estimates; work is underway to update and improve those estimates. Sierra Leone ratified the Paris Agreement in November 2016.

Energy and Transport

The Ministries of Transport and Aviation and that of Energy are the main sources of Sierra Leone's CO2 emission although the other sources are by no means less important. The following emission reduction strategies have been proposed by them for phase implementation with the availability of necessary resources.

Lead-Free petrol

- Mass transportation (road and water) for passengers and cargo.
- Creation of pay parking lots
- Enforcement of regular maintenance regulations for vehicles
- Improve the water transport system
- Regulate cost of duty to improve transport (tax incentives)
- Regulation/policies on fuel use and consumption

Industry (Energy and IPPU)

- Harnessing more of the country's Hydroelectric power potential
- Switching and promotion for renewable energy (solar energy and LPG) in chiefdom headquarters and relater towns and for street lighting
- Use of other fuels such as ethanol, and oxygen especially for domestic usage such as cooking.
- Development of alternative energy sources such as Biofuels (from corn, sugarcanes, rice husk etc.)

Agriculture

- Climate Smart agriculture
- Water management in rice cultivation and maintenance of soils.
- Low amount of organic matter
- Use of rice-straw, compost, biogas residues
- Mineral fertilizers
- Fallow incorporation and mulching

Forest and Other Land Use

- Forestry protection, conservation and increase
- Reforestation, afforestation and Agroforestry
- Urban and Community Forestry.

Waste

- Waste incineration
- Composting
- Recycling.

c) Provincial Mitigation Actions

- Support the establishment of adequate weather stations around the country to provide reliable and adequate weather data that will be useful to properly inform farmers.
- Provide adequate support to the Sierra Leone Agricultural Research Institute as well as Njala University to develop appropriate crop varieties and production practices that will enhance resilience to adverse weather conditions
- Develop and maintain seed banks to provide a variety of seed types that preserve biological diversity and enable farmers to make informed choices.
- Promote innovative and adaptive approaches such as irrigation and water harvesting, to protect farmers from variability in rainfall.
- Make provision for the construction of appropriate roads particularly feeder roads in the rural areas to be able to withstand increasing rainfall.
- Take appropriate by providing appropriate infrastructure, social services and mechanization of agriculture in the rural areas to slow down massive movements of youths into urban areas.
- Mainstream Climate Change into Succeeding Agricultural Development Strategies.
- Develop modelling approaches and tools to allow assessment of impacts of climate change on export and domestic crops and meat production. Detailed crop/country/climate-specific assessments are required to inform an adaptation programme and policy development.
- Develop regional links to fund and promote plant breeding programmes for common crops.
- Adaptation strategies include the development of crop varieties with increased temperature, drought and pest resistance.
- Review approaches to integrated pest management under climate change.

4.5. Data/information gaps

In providing information on mitigation policies and actions several challenges were encountered. Specifically, experts faced serious constraints in Nationally Appropriate Mitigation Action (NAMA) :

Sierra Leone expressed a bid to make a significant contribution towards the reduction of the sources and potential sources of GHG emissions (mainly Carbon Dioxide (CO2), Methane (CH4) and to the enhancement of carbon sinks; and would undertake the following NAMAs listed below:

a. The establishment of the National Secretariat for Climate Change
b. Institutional strengthening and capacity-building for environmental protection and management as well as the country's mitigation and adaptation efforts regarding climate change. It aims to increase conservation efforts through:

    i. The establishment of a network of 12 protected areas by 2015
    ii. The sustainable management and protection of forest reserves and catchment areas, Including mangroves, and coastal and inland wetlands;
    iii. The delineation and restoration of vulnerable habitats and ecosystems in west Sierra Leone
    iv. The provision of support for a national assessment of forest resources.

c. The improvement of forest governance to maintain the proportion of land area covered by forests to at least 3.4 million hectares (ha) by 2015, through the development of legislation, regulations and by-laws for environmental protection, including the control of deforestation, firewood collection and charcoal production, and capacity-building, training and support for law enforcement services and the Ministry of Agriculture (Forestry Department)
d. The setting/development of air, water and soil quality standards, and ensuring regular assessments and monitoring through control programmes
e. The introduction of conservation farming and the promotion of the use of other sustainable agricultural practices such as agroforestry
f. The development of an Integrated Natural Resources and Environmental Management Programme, including sustainable land management programmes, particularly in relation to ecosystems
g. The expansion of clean energy utilization (e.g. solar, mini-hydroelectric power, LPG, biomass stoves);
h. The development of energy efficiency programmes through sensitization and awareness-raising campaigns. The sustainable production of charcoal and the reduction of dependence on firewood;
i. The development of alternative energy sources, such as biofuels from sugarcane, corn, rice husks, etc.;
j. The development of agricultural and urban waste incineration programmes for energy production;
k. Improved waste management through the composting and recycling of waste;

l. The development and enforcement of regulations on the regular maintenance of vehicles. Improving the use of mass transport (e.g., road and water) for passengers and cargo to reduce traffic congestion and GHG emissions.
m. Technology including Energy Supply, Bioenergy, Energy Efficiency Hydropower, Wind Energy Carbon Capture and Storage, Landfill gas collection, Cleaner fuels Geothermal Energy, Solar Energy Ocean Energy Low till / No till

Sierra Leone emphasises the critical role that energy and agriculture play in the economic and social development of its people. With reference to Agriculture, there are expressed priorities its communities are to achieve the following: ensure food security, eradicate poverty and enhance socioeconomic development. With respect to energy, priorities are placed on shifting to the use of renewable energy to ensure: the electrification of urban and rural areas by solar lights thereby reducing Greenhouse Gases (GHGs) emissions, and ensuring environmental and livelihood sustainability by adapting to the effects of climate change and identifying the potential co-benefits of mitigation.

Despite the various forms of financial and technical support in terms of capacity building, raising awareness as well as the BUR funding, there are still a wide range of significant gaps, constraints and problems regarding the mainstreaming of the climate-related issues. The reasons for this condition are briefly presented as follows:

- Limited institutional capacity of the public administration (political influence, brain drain from public institutions towards NGO and private companies. Lack of professional knowledge and skills of the employees in the public administration and public utilities are significant barriers towards implementation of innovative solutions and acceptance of new practices.
- Most employees in public institutions both at the national and local level are not very familiar with the potentials and possibilities for implementation and financing of climate-change related projects.
- Non-existence of web network platform in terms of available data from all relevant institutions and companies. In Sierra Leone, there is no detailed legislation as an obligation to use IT solutions for the flow of information on BUR. The control of the reliability and quality of the received information is still at a low level. The application of this platform is a great step to significant improvement of the level of quality control of the received data. This is a solid base for further upgrades to use the same platform in terms of climate change projects and activities, as well as the calculation of the grid emission factor.
- There is a lack of capacity-building activities in terms of climate financing, which could be identified among the weaknesses of the current status.
- Lack of public campaigns and information for the public. Although in the past two years the number of projects and activities in terms of climate change awareness is increasing, there is still insignificant progress on the issue, since many other indicators affect the situation and implementation of energy efficiency/ climate change mitigation measures. Both, increasing awareness as well as financial incentives could be a solid approach, taking into consideration the energy poverty and the quality of life in the country in general.

- Lack of transparency in terms of providing information on climate change from relevant institutions. In addition, despite the obligation to provide information that is subject to public disclosure, the entities are very often not available for sharing information.
- Seeming a lack of cooperation between different sectors and Ministries in Sierra Leone, which could also be related to constraints in terms of professionalism, promotion system, over-employment, political influence, etc. These indicators of constraints can be attributed to non-efficient daily operations affecting sectors. Therefore, this translates to the human factor of mismanagement; and the establishment and existence of a web network platform in terms of data availability from all relevant institutions and companies could be a solid base to overcome this constraint.
- Ministries and the Directorate should be informed and alarmed in terms of certain decreasing trends when it comes to capacity building availability versus using the opportunities. Moreover, strengthened efforts must be focused on knowledge dissemination through as many as possible individuals in public institutions, companies, universities, NGO's and other stakeholders.

4.6. Suggestions and needs for improvement of reporting

To overcome the data/information gaps related to mitigation actions and their effects, the following capacity-building are identified:

a) Enhance the capacity of experts to estimate quantitative emission reduction co-benefits from the programmes and projects, apply methodologies and assumptions for mitigation actions and report them, apply the relevant tools for assessing the implementation of mitigation actions, and report the progress of implementation and the results achieved;

b) Enhance the capacity of national experts to develop a low-carbon development strategy;

c) Enhance institutional and expert capacity (such as of the DNA) to document and report on international market mechanisms;

d) Enhance the implementation of the domestic MRV system for mitigation actions and the capacity of institutions for data collection, storage and update:

   i. To raise the awareness of institutions so that they mainstream climate change considerations in programme and project development;

   ii. To build the capacity of all stakeholders on progress indicators;

   iii. To establish a collaborative framework between the different institutions to facilitate access to information on the progress of implementation of mitigation-related programmes and projects;

e) Enhancing the capacity to identify quantitative and qualitative indicators for each sectoral mitigation action;

f) Enhancing the sectoral capacity of relevant ministries and institutions to enable the provision of estimates of expected and achieved GHG reductions and non-GHG mitigation benefits for prioritized sectoral mitigation actions, policies and measures through different means;

g) Strengthening and managing the participation of the private sector in the implementation of emission reduction actions and the alignment of various financial mechanisms, in particular, supporting existing working groups in the implementation of financial climate risk analyses in the banking sector and green tax mechanisms;

h) Strengthening existing subnational capacities to meet the needs for reporting and monitoring at the subnational level under the Climate Change Framework Law, in particular for alignment and reporting of national and subnational measures;

i) Developing a system for following up on mitigation actions over time, in different sectors and at different government levels to increase the capacity to track the results obtained by different actions, in particular regarding the capacity to nest, align and coordinate the accounting of those mitigation actions, considering different government levels, sectors and participants.

Chapter 5: Finance, Technology and Capacity Building Needs and Support Received

In recent years, the country has made progress in developing climate change actions for adaptation and mitigation, through the articulation of strategies at the sectoral, national and regional levels. Despite these advances and the recognition of the problems facing the country's future, there are still some needs to be met and challenges to be overcome in terms of financing, capacity and technical assistance in the different areas of climate change management. Meeting these challenges will make it possible to increase the installed technical and financial capacities, the generation and implementation of public policies, and the enhancement of technical capacities. It will further improve the performance of the institutions in charge of managing the processes associated with climate change mitigation.

5.1. Support needed

This section provides information on Sierra Leone's constraints and gaps and related financial, technical and capacity-building needs.

Many constraints and gaps exist for the reporting of information and at the frequency required by the decisions of the Conferences of the Parties. Reducing constraints and mitigating gaps will be possible in the medium to long term through nationally planned improvement efforts, but this will require urgent and sustained support from bilateral, multilateral and donor partners.

One of the most urgent and pressing challenges the country faces in fulfilling its reporting obligations in accordance with the articles and decisions of the Convention and its implementation concerns the availability of the technical capacity of the country in several areas: human, institutional, methodological and financial.

Generally, Sierra Leone faces the following challenges:

- ***Notification:***

Many constraints and gaps exist for the reporting of information and at the frequency required by the decisions of the Conferences of the Parties. Reducing constraints and mitigating gaps will be possible in the medium to long term through nationally planned improvement efforts, but this will require urgent and sustained support from bilateral, multilateral and donor partners.

- ***Implementation***

The implementation of mitigation actions is a major challenge for Sierra Leone, in light of the multiple constraints and gaps that exist in different areas, particularly at the institutional, organizational and individual levels. It is essential to create a favourable environment in the country. The various barriers must be removed to accelerate the mitigation process while increasing the identification of new mitigation projects and preparing project proposals for funding.

- ***Technical and capacity-building needs***

One of the most urgent and pressing challenges the country faces in fulfilling its reporting obligations in accordance with the articles and decisions of the Convention and its implementation

concerns the availability of the technical capacity of the country in several areas: human, institutional, methodological and financial.

The different constraints and gaps identified are related to three (3) categories as shown in the following table.

Table 16: Constraints and gaps

Type of constraints and gaps	Sector	Description
Capacity building	**All sectors**	Difficulties encountered in accessing and mobilizing support for capacity building related to: The availability of capacity building according to demand; The breadth and depth of the training.
		Constraints related to the collection, compilation, classification, documentation and archiving of information relating to capacity building available to implement activities, measures and programs with multiple uses or with co-benefits linked to climate change: Disaggregated availability of capacity-building information; Institutional challenges related to the coordination of support for capacity building.
		Challenges related to the development and maintenance of capacities.
Technical	**All sectors**	Difficulties encountered in accessing and mobilizing technical support
		Constraints related to the collection, compilation, classification, documentation and archiving of information relating to the technical support available to implement activities, measures and programs with multiple uses or with co-benefits in relation to climate change:
Financial	**All sectors**	Difficulties encountered in accessing and mobilizing financial resources (e.g., understanding financial reporting requirements for different donors and level of use of country systems for reporting by different donors)
		Collection and compilation of information relating to the financial resources available to implement activities, measures and programs with multiple uses or with co-benefits related to climate change
		Level of transparency related to climate change financing, including non-monetary transfers for technical assistance and training
		Technical constraints on how to collect, compile and store climate change finance data

		Consolidate a permanent team of professionals dedicated to activities related to GHG inventories (elaboration and updating, implementation of the improvement plan, strengthening of the MRV system, emission reference scenarios, elaboration of different reports, analysis of results, etc.). Ideally, this team should be made up of consultants and institutional employees including sector leaders, professionals in statistics, support for quality control, specialists to integrate the gender approach, and a coordinator.
		Institutional Challenges in Coordinating Funding for Climate Change Action
		Define and establish budget allocation structures at the national level (sectoral and institutional), to ensure the financial sustainability of the MRV-related activities. Create efficient mechanisms for timely management of international resources to support the financial sustainability of MRV-related activities.

5.2. Support needs for capacity building

Capacity building is essential to increase capacities for implementing technologies, monitoring emissions and calculating emission reductions resulting from policies and measures. Also, capacity building should be oriented towards increasing capacities:

- Enhance the capacity of staff and national experts to identify and implement the most appropriate tools for assessing and overcoming gaps and constraints (including constraints related to the collection, collation, classification, documentation and archiving of information on the implementation of activities, measures and programmes that have multiple uses or climate change co-benefits);
- Enhance national capacity to implement the domestic MRV system;
- Enhance national capacity to establish a collaborative framework to facilitate better coordination between public and private institutions and civil society organizations to enable the collection and documentation of information on their needs;
- Enhance national capacity to establish a collaborative framework to facilitate the implementation of a study on technology needs and enable the reporting of information on the technology needs determined at the national level.
- Agencies responsible for data collection to understand the data and develop formats that facilitate data collection;
- Sectors to develop baseline/reference levels of emissions as a basis for measuring mitigation actions;

- The development of functional databases to generate information on GHG emissions, the effects of mitigation actions, donor financial flows and capacity building and technology transfer activities.

5.2.1. Technical support needs

In terms of technical capacities for GHG inventory studies, mitigation and technical needs, there are gaps between institutions and between sectors. In most cases, institutions and sector managers find it very difficult to calculate estimates of emissions and reductions. There are also gaps in tracking the budgets used to fund activities.

5.2.2. Financial support needs

The needs for financial support have been identified, in particular for the implementation of mitigation activities and capacity building are linked to:

- Establishment of a national system for the acquisition, use and dissemination of activity data and information relating to climate change;
- Networking of data holding structures;
- development of country-specific emission factors;
- support for the development of the national policy on climate change;
- support for the development of the low GHG emission development strategy;
- Promotion of low-carbon modes of transport;
- Implementation of energy-saving strategies;
- Realization of structuring investments for the protection of the coast;
- Capacity Building on IPCC 2006 Methodologies;
- capacity building on mitigation assessment tools;
- Study on opportunities for mobilizing climate resources;
- Raising awareness by private sector actors and CSOs;
- Promotion of renewable energies (solar thermal, photovoltaic cell, microhydraulic, wind turbine, etc.) by facilitating access to these technologies;
- Development of endogenous technologies.

New sources of funding and cooperation need to be explored, allowing the development of MRV-related activities in a constant way through time.

The following table 17 is a summary of a list of support needed.

Table 17: List of support needs

Need to be identified	Support needed	A specific type of support requested [technology transfer, capacity building, financial support]	When and for how long is support needed?	Where financial support is needed, please indicate	
				National budget available in USD	Financial support needed in USD
Capacity building needs					
Legal framework for GHG data collection and guidelines for data management	Capacity building to set up Legal framework for GHG data collection and guidelines for data management	Capacity building	2023	NA	NE
Institutional arrangements for data collection and management established under EPA's coordination in prioritized sectors for both mitigation and adaptation	Capacity building to set up institutional arrangements for GHG data collection and guidelines for data management	Capacity building	2023	NA	NE
Limited understanding of 2006 IPCC guidelines	Capacity building for 2006 IPCC sectors	Capacity building	2023	10,000	30,000
Limited understanding of 2006 IPCC software	Capacity building for 2006 IPCC software	Capacity building	As soon as possible	10,000	30,000
Develop technical data management guidelines/methodologies aligned with the 2006 IPCC Guidelines for all prioritized sectors	Capacity building to Develop technical data management guidelines/methodologies aligned with 2006 IPCC Guidelines for all prioritized sectors	Capacity building	As soon as possible	5,000	25,000
Develop and operationalize a QA/QC Plan for UNFCCC reporting including Standard Operating Procedures (SOP) based on IPCC 2006 guidelines	Capacity building to Develop and operationalize a QA/QC Plan for UNFCCC reporting including Standard Operating Procedures (SOP) based on IPCC 2006 guidelines	Capacity building	As soon as possible	5,000	20,000

Need to be identified	Support needed	A specific type of support requested [technology transfer, capacity building, financial support]	When and for how long is support needed?	Where financial support is needed, please indicate	
				National budget available in USD	Financial support needed in USD
Develop capacity of QA/QC of institutions	Capacity building to develop capacity of QA/QC of institutions	Capacity building	As soon as possible	5,000	20,000
Strengthen the capacity of national sectoral experts from relevant institutions to improve methodologies and procedures for gathering relevant AD on the consumption of international aviation and marine bunker fuels	Capacity building to strengthen the capacity of national sectoral experts from relevant institutions to improve methodologies and procedures for gathering relevant AD	Capacity building	As soon as possible	10,000	30,000
Enhance the capacity of the national network of research institutions to conduct studies, research and assessments, focusing on improving the system for data collection needed for the development of the GHG inventory, and developing data management and archiving systems and country-specific EFs for relevant sectors (e.g., energy, IPPU and AFOLU), including to move to higher-tier estimation methodologies in the case of the most relevant key categories	Capacity building of the national network of research institutions to conduct studies, research and assessments, focusing on improving the system for data collection needed for the development of the GHG inventory	Capacity building	As soon as possible	10,000	40,000
Enhance the efficiency of the implementation of the QA/QC plan and QA/QC verification activities to minimize errors, ensure better	Capacity building to enhance the efficiency of the implementation of the QA/QC plan and QA/QC verification activities to minimize	Capacity building	As soon as possible	5,000	20,000

Need to be identified	Support needed	A specific type of support requested [technology transfer, capacity building, financial support]	When and for how long is support needed?	Where financial support is needed, please indicate	
				National budget available in USD	Financial support needed in USD
time-series consistency and enhance the accuracy and transparency of the reporting	errors, ensure better time-series consistency and enhance the accuracy and transparency of the reporting				
Strengthen the capacity of the National Ozone Unit to achieve more accurate data collection and improve methodologies and procedures for gathering relevant AD on emissions of fluorinated gases (e.g., collecting AD from companies that import, use, dispose of, recover and recycle refrigerants and refrigerant equipment in Sierra Leone)	Capacity building to Strengthen the capacity of the National Ozone Unit to achieve more accurate data collection and improve methodologies and procedures for gathering relevant AD on emissions of fluorinated gases	Capacity building	As soon as possible	10,000	40,000
Enhance the capacity of national experts to develop a low-carbon development strategy	Capacity building to enhance the capacity of national experts to develop a low-carbon development strategy	Capacity building	As soon as possible	5,000	10,000
Enhance institutional and expert capacity (such as of the DNA) to document and report on international market mechanisms	Capacity building to ehance institutional and expert capacity (such as of the DNA) to document and report on international market mechanisms	Capacity building	As soon as possible	10,000	50,000
To establish a collaborative framework between the different institutions to facilitate access to information on the progress of	Capacity building to establish a collaborative framework between the different institutions to facilitate access to information on the progress	Capacity building	As soon as possible	5,000	45,000

Need to be identified	Support needed	A specific type of support requested [technology transfer, capacity building, financial support]	When and for how long is support needed?	Where financial support is needed, please indicate	
				National budget available in USD	Financial support needed in USD
implementation of mitigation-related programmes and projects	of the implementation of mitigation-related programmes and projects				
Enhance the implementation of the domestic MRV system for mitigation actions and the capacity of institutions for data collection, storage and update	Capacity building to enhance the implementation of the domestic MRV system for mitigation actions and the capacity of institutions for data collection, storage and update	Capacity building	As soon as possible	10,000	50,000
Enhance the technical capacity of national experts from the relevant institutions in the preparation of NCs and BURs to facilitate reporting continuously	Capacity building to enhance the technical capacity of national experts from the relevant institutions in the preparation of NCs and BURs to facilitate reporting continuously	Capacity building	As soon as possible	10,000	30,000
Enhance the capacity of staff and national experts to identify and implement the most appropriate tools for assessing and overcoming gaps and constraints (including constraints related to the collection, collation, classification, documentation and archiving of information on the implementation of activities, measures and programmes that have multiple uses or climate change co-benefits)	Capacity building to enhance the capacity of staff and national experts to identify and implement the most appropriate tools for assessing and overcoming gaps and constraints	Capacity building	As soon as possible	10,000	30,000
Enhance national capacity to establish a collaborative framework to facilitate better coordination	Capacity building to enhance national capacity to establish a collaborative framework to facilitate better	Capacity building	As soon as possible	12,000	28,000

Need to be identified	Support needed	A specific type of support requested [technology transfer, capacity building, financial support]	When and for how long is support needed?	Where financial support is needed, please indicate	
				National budget available in USD	Financial support needed in USD
between public and private institutions and civil society organizations to enable the collection and documentation of information on their needs	coordination between public and private institutions and civil society organizations to enable the collection and documentation of information on their needs				
Enhance national capacity to establish a collaborative framework to facilitate the implementation of a study on technology needs and enable the reporting of information on the technology needs determined at the national level	Capacity building to enhance national capacity to establish a collaborative framework to facilitate the implementation of a study on technology needs and enable the reporting of information on the technology needs determined at the national level	Capacity building	As soon as possible	10,000	30,000
Technical support needs					
Networking of data-holding structures	Technical support for networking of data-holding structures	Technology transfer	2023	NE	NE
Promotion of renewable energies (solar thermal, photovoltaic cell, microhydraulic, wind turbine, etc.) by facilitating access to these technologies	Technical support for the promotion of appropriate renewable energies (solar thermal, photovoltaic cell, microhydraulic, wind turbine, etc.) by facilitating access to these technologies	Technology transfer	As soon as possible	NE	NE
Development of endogenous technologies	Technical support for the Development of endogenous technologies	Technology transfer	As soon as possible	NE	NE

Need to be identified	Support needed	A specific type of support requested [technology transfer, capacity building, financial support]	When and for how long is support needed?	Where financial support is needed, please indicate	
				National budget available in USD	Financial support needed in USD
Development of country-specific emission factors	Technical support for the Development of country-specific emission factors	Technology transfer	2023	NE	NE
Financial support needs					
Development of country-specific emission factors	Financial support for the Development of country-specific emission factors	Financial support	2023	NA	NE
Support for the development of the national policy on climate change	Financial support for the development of the national policy on climate change	Financial support	2023	NA	NE
Promotion of low-carbon modes of transport	Financial support for the promotion of low-carbon modes of transport	Financial support	As soon as possible	NA	NE
Implementation of energy-saving strategies	Financial support for the Implementation of energy-saving strategies	Financial support	As soon as possible	NA	NE
Study on opportunities for mobilizing climate resources	Financial support for the Study on opportunities for mobilizing climate resources	Financial support	2023	NA	NE
Capacity building on mitigation assessment tools	Financial support for Capacity building on mitigation assessment tools	Financial support	2023	NA	NE
Establishment of a national system for the acquisition, use and dissemination of activity data and	Financial support for the establishment of a national system for the acquisition, use and dissemination of activity data and	Financial support	2023	NA	NE

Need to be identified	Support needed	A specific type of support requested [technology transfer, capacity building, financial support]	When and for how long is support needed?	Where financial support is needed, please indicate	
				National budget available in USD	Financial support needed in USD
information relating to climate change	information relating to climate change				
Networking of data-holding structures	Financial support for the Networking of data-holding structures	Financial support	2023	NA	NE
Raising awareness by private sector actors and CSOs	Financial support for Raising awareness by private sector actors and CSOs	Financial support	2023	NA	NE
Promotion of renewable energies (solar thermal, photovoltaic cell, microhydraulic, wind turbine, etc.) by facilitating access to these technologies	Financial support for the promotion of renewable energies (solar thermal, photovoltaic cell, microhydraulic, wind turbine, etc.) by facilitating access to these technologies	Financial support	As soon as possible	NE	NE
Development of endogenous technologies	Financial support for the Development of endogenous technologies	Financial support	As soon as possible	NA	NE
Coordination of NAMA structure	Financial support for the salary of staff members leading on the setup of the coordination structure	Financial support	2023	5,000	50,000
Resources mobilization Unit	Financial support for the salary of staff members of the resource mobilization Unit	Financial support	2023	5,000	50,000
Funding for the implementation of market mechanisms	Financial support for the DNA for the implementation of market mechanisms	Financial support	2023	NA	NE

5.3. Financial support received

5.3.1. Financial support received from the Global Environment Facility, bilateral sources, and multilateral sources

- **Support received from GEF, bilateral/multilateral sources**

The Global Environment Facility (GEF) helps Sierra Leone with the various enabling activities in terms of Capacity building and technical assistance ranging from this project's PIF preparation and present implementation to the Capacity Building Initiative for Transparency (CBIT) project that the Sierra Leone Government has just launched for putting in the various modalities for the eventual MRV of the Paris Agreement.

The Global Environment Facility (GEF) provides financial assistance to prepare Sierra Leone's BURs under guidance from the COP. This financing is made available under projects called BUR, which is implemented through the United Nations Environment Programme (UNEP). For BUR this sum totaled $392,300, and $15,000 for an initial stocktaking exercise, stakeholders' consultations and the preparation of the project proposal. This preliminary exercise is a critical step so that BUR builds on the results, experiences and lessons learned from NCs thus ensuring improvements are carried out more cost-effectively and are not duplicative.

One function of the UNFCCC Secretariat is to facilitate the provision of financial and technical assistance to non-Annex I Parties as they prepare national communications. One mechanism for assisting is through the Consultative Group of Experts (CGE). In the region, the CGE conducted hands-on training workshops on greenhouse gas (GHG) inventories and vulnerability and adaptation (V&A) assessments, as well as a global one on mitigation analysis in the context of the preparation of national communications. The thematic training materials developed and used at these training workshops have been used by Sierra Leone national experts during the preparation of national communications.

- **Support received from the Green Climate Fund**

Sierra Leone has received several readiness activities supported through GCF's Readiness and Preparatory Support Programme (GCF's Readiness Programme).

- **Support received for the preparation of the BUR1**

Sierra Leone received financial support for the preparation of the BUR1 from the Global Environment Facility (GEF), through UNDP as the executing agency. Indeed, the GEF has approved an amount of US$392,300 to enable Sierra Leone to begin the preparation of its BUR1 after the submission and approval of a project proposal and the implementation plan.

Although the support was received on time and effectively enabled the country to meet its carry-over obligations, it was not able to fully cover the full PRBA preparation costs. Other contributions were solicited.

The following table 18 summarises these funding sources and their impacts on Climate Change national action.

Table 18: List of the capacity building received during the preparation of BUR1

Activity	Capacity building needed	Capacity building received	Source of support
Improved data collection	Data collection and management process	Data Collection and Management Workshop	GEF
Use of IPCC 2006 methodologies	Capacity building on IPCC 2006 guidelines and IPCC 2006 software	Workshop on the use of PCC Methodologies 2006	GEF
Improvement of the BUR1	In-depth review of the BUR1 document	Technical review of the sector assessments of BUR1 chapters	GSP

- **Plans for Development**

Support for the development of the BUR principally came from the Global Environment Facility (GEF) programme. While this is laudable, it is proper for similar support to come from the national Government as it should own the process. Cluster 7 of Sierra Leone's Nation Mid-Term Development Plan 2019-2023 discusses environmental resilience, forestry management, and disaster management. The inclusion of these components, which are pivotal to environmental management, demonstrates that the Government is aware of these challenges. There is a need for interventions to address these environmental issues to be budgeted for in the country's national budget.

The Sierra Leone Environmental Protection Agency (EPA) and Climate Change Secretariat under the Ministry of Environment have limited capacity and the preparation of national communications including the BUR are dependent on the availability of donor support. A roadmap for the development of necessary capacities of state administration and institutions as well as inter-institutional coordination for effective NDC is required. The climate Mainstreaming climate change discourse can be significantly improved by enhanced institutional capacities and inter-sectorial cooperation. Effective strategic planning and institutionalised mechanisms for efficient, hence coordinated implementation of a comprehensive and multi-sectorial climate policy are important aspects for fulfilling the international climate obligations and pledges.

5.3.2. Financial support received from public finance support - bilateral

In addition to the public multilateral finance support, Sierra Leone also has public finance support from several partners as bilateral. Among them, we can cite GCCA/EU.

Table 19: Climate-specific financial support received by origin

	Reporting period (timeframe covered)							
	e.g., 2010-2021							
	Climate-specific amount							
Finance mobilised	Domestic currency	USD equivalent	Status (Committed/ Disbursed)	Funding sources (ODA, OOF, etc.)	Financial instrument (Grant, Concessional loan, Non-conc-essional loan, Equity, Other)	Focus of support (Mitigation Adaptation Cross-cutting, Other)	Sector	Additional information
Public finance support – bilateral	NE	5,000,000	Disbursed	GCCA	Grant	Mitigation	Forest	GCCA
Public finance support – bilateral	NE	NA	Disbursed	EU	Grant	Mitigation	Energy	Chiefdom Headquarter Town Solar Electrification
Public finance support – bilateral	NE	7,000,000	Disbursed	EU	Grant	Mitigation	Energy	Promoting Renewable Energy for Sustainable Development project (PRESSD)
Public finance support – bilateral	NE	18,000,000	Disbursed	USAID	Grant	Adaptation	Cross cutting	Sustainable and Thriving Environments for West African Regional Development (STEWARD)
Public finance support – bilateral	NE	46,000,000	Disbursed	USAID	Grant	Adaptation	Cross cutting	West Africa Biodiversity and Climate Change Programme (WABiCC)
Public finance support – bilateral	NE	NA	Disbursed	UKAID	Grant	Mitigation	Energy	Rural Renewable Energy Project
Public finance support – bilateral	NE	NA	Disbursed	EU	Grant	Mitigation	Cross cutting	West African Peninsula Forest Conservation Project

	Reporting period (timeframe covered)							
	e.g., 2010-2021							
	Climate-specific amount							
Finance mobilised	Domestic currency	USD equivalent	Status (Committed/ Disbursed)	Funding sources (ODA, OOF, etc.)	Financial instrument (Grant, Concessional loan, Non-conc-essional loan, Equity, Other)	Focus of support (Mitigation Adaptation Cross-cutting, Other)	Sector	Additional information
Public finance support – bilateral	NE	652,841	Disbursed	Irish Aid	Grant	Adaptation	Cross-cutting	National early warning system on food and nutrition security in Sierra Leone
Public finance support – Global Environment Facility	NE	20,000	Disbursed	GEF	Grant	SL-NC4 PIF	NC4	Development of the NC4 report to the UNFCCC
Public finance support – Global Environment Facility	NE	20,000	Disbursed	GEF	Grant	CBIT	Cross-cutting	Development of CBIT PDD
Public finance support – Global Environment Facility	NE	1,300,000	Ongoing	GEF	Grant	CBIT	Cross-cutting	Implementation of CBIT project
Public finance support – Global Environment Facility	NE	735,923	disbursed	GEF	Grant	Adaptation	Waters	
Public finance support – Global Environment Facility	NE	25,600,000	disbursed	GEF		Adaptation	Waters	
Public finance support – Global Environment Facility	NE	$3.9 million	disbursed	GEF		Adaptation	Cross cutting	Strengthening Climate information and Early Warning Systems for Climate-resilient Development
Public finance support – Global Environment Facility	NE	$2.1 million	disbursed	GEF, UNDP		Mitigation	Energy	Energy efficient production and utilization of charcoal through innovative technologies and

	Reporting period (timeframe covered)							
	e.g., 2010-2021							
	Climate-specific amount							
Finance mobilised	Domestic currency	USD equivalent	Status (Committed/ Disbursed)	Funding sources (ODA, OOF, etc.)	Financial instrument (Grant, Concessional loan, Non-conc-essional loan, Equity, Other)	Focus of support (Mitigation Adaptation Cross-cutting, Other)	Sector	Additional information
								private sector involvement
Public finance support – Global Environment Facility	NE	$3.4 million	Completed	GEF, UNDP		Adaptation	Waters	Building adaptive capacity of water supply services to climate change in Sierra Leone
Public finance support – Global Environment Facility	NE	$9.9 million	Ongoing	GEF		Adaptation	Coastal	Adapting to climate change induced coastal risks in Sierra Leone
Public finance support – Global Environment Facility	NE	4,000,000	Disbursed	GEF		Adaptation	Cross cutting	Strengthening Climate Information and Early Warning Systems in Africa for Climate Resilient Development and Adaptation to Climate Change
Public finance support – Global Environment Facility	NE	1,768,182	Disbursed	GEF		Mitigation	Energy	Energy Efficient Production and Utilization of Charcoal through Innovative Technologies and Private Sector Involvement
Public finance support – Global Environment Facility	NE	2,940,000	Disbursed	GEF		Adaptation	Waters	Building Adaptive Capacity to Catalyze Active Public and Private Sector Participation to Manage the Exposure and Sensitivity of Water Supply Services to

	Reporting period (timeframe covered)							
	e.g., 2010-2021							
	Climate-specific amount							
Finance mobilised	Domestic currency	USD equivalent	Status (Committed/ Disbursed)	Funding sources (ODA, OOF, etc.)	Financial instrument (Grant, Concessional loan, Non-conc-essional loan, Equity, Other)	Focus of support (Mitigation Adaptation Cross-cutting, Other)	Sector	Additional information
								Climate Change in Sierra Leone
Public finance support – Global Environment Facility	NE	4,000,000	Disbursed	GEF	Grant	Adaptation	Waters	
Public finance support – Global Environment Facility	NE	1,758,182	Disbursed	GEF	Grant	Mitigation	Energy	SPWA-CC: Promoting Mini Grids Based on Small Hydropower for Productive Uses in Sierra Leone
Public finance support – Global Environment Facility	NE	392,300	Ongoing	GEF	Grant	SL-BUR	Cross cutting	Draft 3 in circulation before validation next month
Public finance support – Global Environment Facility	NE	2,644,800	Disbursed	GEF	Grant	Adaptation	Agriculture	Integrating Adaptation to Climate Change into Agricultural Production and Food Security in Sierra Leone
Public finance support – Green Climate Fund	NE	10.000.000	Ongoing	GCF	Grant	Adaptation		The project is categorised as category C (GCF category)
Public finance support – Green Climate Fund	NE	34.000.000	Committed	GCF	Grant	Adaptation		The core problem this project will address is that coastal communities
Public finance support – Green Climate Fund	NE	250.000.000	Committed	GCF	Equity	Mitigation	FOLU	

	Reporting period (timeframe covered)							
	e.g., 2010-2021							
	Climate-specific amount							
Finance mobilised	Domestic currency	USD equivalent	Status (Committed/ Disbursed)	Funding sources (ODA, OOF, etc.)	Financial instrument (Grant, Concessional loan, Non-conc-essional loan, Equity, Other)	Focus of support (Mitigation Adaptation Cross-cutting, Other)	Sector	Additional information
Public finance support – Green Climate Fund	NE	835.500		GCF	Grant	Adaptation	PPF	
Public finance support – other multilateral	NE	NA	NA	DFID/EU	Grant	Mitigation	Energy	Chiefdom Headquarter Town Solar Electrification
Public finance support – other multilateral	NE	NA	Disbursed	ECREEE	Grant	Mitigation	MRV	
Public finance support – other multilateral	NE	NA	Disbursed	EU	Grant	Mitigation	FAT	Reducing Emissions from Deforestation and Forest Degradation (REDD+) Capacity Building in Sierra Leone Project
Public finance support – other multilateral	NE	800,000	Disbursed	UNDP	Grant	Adaptation	Cross-cutting	Environment and natural disaster management project
Public finance support – other multilateral	NE	104.430,000	Disbursed	IFAD, OPEC Fund, and GoSL		Adaptation	Agriculture	Agricultural Value Chain Development Project
Public finance support – other multilateral	NE	10,000,000	Disbursed	World Bank and GoSL	Grant	Adaptation	Cross cutting	Freetown Emergency Recovery Project
Public finance support – other multilateral	NE	56,700,000	Disbursed	World Bank and GoSL		Adaptation	Cross cutting	Resilient Urban Sierra Leone Project
Public finance support – other multilateral	NE	50,000,000	Ongoing	World Bank and GoSL		Adaptation	Cross cutting	Integrated Resilient Urban Mobility Project
SUBTOTAL Public finance support								

	Reporting period (timeframe covered)							
	e.g., 2010-2021							
	Climate-specific amount							
Finance mobilised	Domestic currency	USD equivalent	Status (Committed/ Disbursed)	Funding sources (ODA, OOF, etc.)	Financial instrument (Grant, Concessional loan, Non-conc-essional loan, Equity, Other)	Focus of support (Mitigation Adaptation Cross-cutting, Other)	Sector	Additional information
Private finance mobilized (optional, only if available)	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL	NA	NA	NA	NA	NA	NA	NA	NA

5.4. Technology and capacity-building support received

The support received in climate actions can be categorized into four (4) supporting types: technology transfer, technical support, capacity building, and financial support. A combination of technical support and capacity building is the most common type of support that Sierra Leone has received.

The Global Environment Facility (GEF) has provided technical and capacity-building support to Sierra Leone through various programmes.

In addition to financial support, the Republic of Sierra Leone also received non-monetary support in the form of capacity building, technical support and technology. The summary of non-monetary international climate support received for the period 2013-2021 is depicted below.

5.4.1. Technology support received

As part of the preparation of the BUR1, Sierra Leone received some computer equipment and materials.

5.4.2. Capacity building support received

The National Inventory compilers, GHG data providers and technical officials from the Government received GHG data Quality Assurance and Quality Control (QA/QC) training from the UNFCCC and other institutions to enhance the quality of activity data shared with national inventory compilers.

Some capacity-building initiatives were also conducted to mobilize climate finances through the development of bankable project proposals.

- Data collection and management process;
- Use of 2006 IPCC methodologies and 2006 IPCC software;
- Use of tools for mitigation;
- Capacity building in MRV.

Reporting period (timeframe covered)					
e.g., 2010-2021					
Type of support Technology transfer	Support activity	Year(s) received	Status [ongoing, finalised]	Focus [mitigation, adaptation, unspecified]	Source of support
Technology transfer	Equipment BUR1	2017	Finalised	All sectors	FEM
Technology transfer	Technical support	2017	Finalised	All sectors	FEM
Technology transfer	Bur1 preparation	2017	Finalised	Cross-cutting	FEM

Table 20: Climate-specific technology received in the reporting timeframe

Table 21: Capacity building support received in the reporting timeframe

Reporting period (timeframe covered)					
e.g., 2010-2021					
Type of support capacity building	Support activity	Year(s) received	Status [ongoing, finalised]	Focus [mitigation, adaptation, unspecified]	Source of support
Data collection and management process	Data collection and management process	2017	Finalised	All sectors	UNDP
Use of 2006 IPCC methodologies	Capacity building on IPCC 2006 guidelines	2017	Finalised	Inventory	UNFCCC/FEM/ UNDP/UNEP
Use of 2006 IPCC software	Capacity building 2006 IPCC software	2017	Finalised	Inventory	UNFCCC/FEM/ UNDP/UNEP
Continuous training of new experts in IGES	Continuous training of new experts in IGES	2017	Finalised	Inventory	UNFCCC/FEM/ UNDP/UNEP
Use of tools for mitigation	Capacity building for the establishment of mitigation scenarios	2018	Finalised	Mitigation	NA
In-depth review of the BUR1 document	In-depth review of the BUR1 document	2021	Finalised		GSP/UNEP/UNDP
Capacity building REDD+	Capacity building REDD+	2013	Finalised	Mitigation	GCCA

Reporting period (timeframe covered)					
e.g., 2010-2021					
Type of support capacity building	Support activity	Year(s) received	Status [ongoing, finalised]	Focus [mitigation, adaptation, unspecified]	Source of support
Adaptive Capacity for Waters	Capacity building Waters	2012 -2017	Completed	Adaptation	GEF
MRV	Capacity building in MRV	2017	Finalised	Mitigation	ECREEE
Adaptation	Capacity building	2015 - 2019	Completed	Adaptation	GEF/UNDP

5.5. Data/information gaps

In most cases in Sierra Leone, the preparation of different strategies and feasibility studies do not contain clear priorities in terms of using funding, nor is there strong commitment, but significant fluctuation in setting the priorities.

Energy and environmental-related decision making are divided into two distinct Ministries. Thus, close cooperation between the Ministries in terms of energy and climate issues is a must, which will result in solid cooperation with the United Nations Framework on Climate Change (UNFCC) and Energy Community and other Institutions.

One of the key problems is the inconsistency of the policymakers at both the national and local levels to implement the chosen directions or scenarios addressed in the documents that are prepared by means of grants and other types of donor financing. Another potential constraint to the effective utilization of policy and programmes recommendations is the lack of coordination between the responsible institutions and stakeholders. This can postpone or even suspend the realization of the climate mitigation plans and programmes. If this miss-coordination undermines the support necessary for the implementation of the relevant strategies and corresponding action plans, this could produce unexpected administrative constraints in the whole hierarchy system of decisions. This barrier can be remedied by the establishment of a coordination scheme for effective inter-sectorial cooperation in the design and implementation of strategic actions for climate change mitigation.

The secondary legislation related to the efficient use of energy is still not complete to a level where it can be practically applied. There is no legislation which will define the national RES and energy savings objectives, as well as programmes and action plans with regulatory and economic measures, specific roles of institutions, time schedules and financing. Increasing the share of renewable energy sources is not possible without adequate incentive providing primary and secondary legislation.

What is also worth mentioning is that structures for the Transfer of Climate Technologies are still not designated. This is mainly owned to the limited institutional capacity of the Ministry of Environment to coordinate the national technology transfer activities and the identified lack of relevant national authorities or academic institutions that can coordinate the National Technology Transfer.

5.6. Suggestions and needs for improvement of reporting

Suggestions for improvement are related to the following actions:

a) Strengthening national capacity to establish a national system for collecting, using and disseminating AD and other information related to climate change reporting;
b) Formalisation of agreements between producers and users of data based on legislative and regulatory texts;

c) Building capacity of the producing structures producing or holding the data on the appropriate format for data collection;
d) Building national capacity to identify and report on nationally determined technology needs;
e) Operationalisation of the support MRV system;
f) Development of a QA/QC plan for the energy and AFOLU sectors;
g) Enhance the technical capacity of national experts from the relevant institutions in the preparation of NCs and BURs to facilitate reporting continuously;
h) Enhance the capacity of the relevant experts to design and implement the relevant institutional arrangements to facilitate the preparation of NCs and BURs continuously, including approaches to sensitize decision-makers;
i) Capacity building in the assessment of uncertainties and the use of software by sector experts.

CHAPTER 6 :
Additional Observations

6.1. Steps for the calculation of National emission factors in the energy sector

During the development of the CBIT one of the action points that came out from most of the consultations was for Sierra Leone like some LDCs/African countries to develop its own Emission Factors (EF) at least in some subcategories of GHG emission sources. At the sub-regional level, it was noted that the Forestry Institute in Kumasi (Ghana) take the lead in close collaboration with the University of Nigeria under the various Countries' REDD+ Preparedness (or similar enabling activities of GEF or other sources) projects to assign their personnel to work the institute/University to get the necessary algometric equation for those forest trees that are of interest in one's country but not yet researched for EF database of the above institutions.

It is hoped that the Forestry division and Njala University's Agriculture Faculty will jointly make available research personnel to undertake the one in the AFOLU sector.

Similar venture is also encouraged in the Science and engineering faculties for other sectors.

6.2. Advantages of computation of National Emission Factor

The Sierra Leone Government recognizes the importance of the computation of the National Emission Factors which will accord researchers the opportunity to link their theoretical knowledge with practical application as well as use the bases of "national flexibility" in addressing climate change in conformity with the UNFCCC convention. To show the government's determination and commitment to address Climate Change the present National Development Plan of 2019-2024 code-named the "New Direction" dedicated Cluster 7 of the eight different development trajectory clusters to focus on the Environment, Climate Change and Disaster Management in line with the Sustainable Development Goal13 of Climate Action. To march words with actions, each MDA now allocates some fraction of their national budget allocation address Cluster7 that is partly available as the government's Co-funding apart from the purely holistic government intervention projects in Climate Change. For example, at the inauguration of the median Ministry of Environment EPA-SL, the President launched the planting of 1 million acres of trees in the next two years. With our Emission Factors computed for these trees, we will be able to accord the necessary carbon upset as required by the Paris Agreement.

6.3. The Role of the University in the Determination of National Emission Factors

As highlighted above, the Universities will play a pivotal role during the CBIT National Emission Factor determination whereby the researchers will use the IPCC guide lines and software for the eventual emission calculation.

6.4. What is actually done – Rundown of the type of scenario used based on the IPCC guidelines

For the current BUR, the default emission factors were used in each category. However, the data for the Energy and AFOLU sectors were freshly collected and used in the analysis using the IPCC software of 2006. It is hoped that this will serve as a baseline for subsequent BURs' evaluations in the "MRVs of Action"

6.5. The use of an algometric equation in the determination of Emission factors.

Algometric Equations are used for forest carbon calculations. The Institute of Forestry and the University of Nigeria are well-advanced in the development of these equations for some of the trees that are common in the region. There are opportunities for countries to send research fellows to understate the exercise for specific trees of national interest for inclusion in the inventory. It is therefore very useful for National Algometric equations development so that the exact carbon absorption capacity of the country's forest is calculated. As there are scores of specific forest trees, this process that will start with the CBIT will be ongoing for several years of the National Communications and BURs.

6.6. Adaptation

Sierra Leone's vision for adaptation is drawn from the iNAP, to enhance adaptive capacity, strengthen resilience and reduce vulnerability by half by 2030 through increased risk awareness, improvements in rule compliance, increased institutional capacity and an integrated approach to adaptation in development policy and programs across sectors and scales. The above visions support proposals in the National Climate Change Policy (NCCP), which was revised in early 2021. The following represents the vision for adaptation as contained in the updated NDC of July 2021.

It also expands on the goals set for adaptation in the iNAP, which include increasing resilience capacity at all scales; supporting an integrative approach to climate change adaptation programming and policymaking; allocating 10% of annual national budgets to climate change adaptation across sectors; harmonizing climate-relevant policies and regulations to improve coordination and cross-sector linkages; mainstreaming adaptation into local development plans by 2025; institutionalize NAP implementation through laws, policies, and regulations; establishing a National Trust Fund for channelling adaptation support across sectors; and securing 40% of international development funding to support adaptation priorities across different sectors.

These national goals contribute to achieving the Global Goal of adaptation by reducing vulnerability through integrating adaptation considerations into all relevant plans, policies, and strategies, and prioritizing and planning for adaptation. They also ensure that the adaptation component of the NDC becomes a strategic and ambitious vehicle for capturing, reporting and updating commitments and progress, as well as aligning long-term national development priorities with the SDG framework. Moreover, the goals contribute to improving the delivery of climate services as prescribed in the National Framework for Climate Services (NFCS). The NFCS will benefit a wide range of sectors and climate intervention areas, including biodiversity, health, energy, agriculture,

human settlements, water etc. By implementing the NDC, key actors, including SLMet, can produce sector-specific products to enable informed decision-making in the context of the effective, efficient and equitable delivery of climate services.

a) Adaptation planning

The goals, actions, and plan proposed for adaptation in this section provide a country-driven and comprehensive approach to planning and implementation across multiple sectors and at scale. The approach sets out the adaptation outcomes the country is aiming to achieve, as well as how they will be achieved through iterative planning, public engagement, GESI mainstreaming, and other processes required for effective adaptation. These actions will be reviewed as the knowledge of climate risks and vulnerabilities across sectors and communities increases, as well as when the needs and capacities of different stakeholders evolve. The following analysis shows the progress made with the implementation of adaptation measures since 2015 (see Table 22).

Table 22: Climate adaptation progress since 2015

Strategy	Associated Priority Sector(s)	Progress made since 2015
Estimation, in a sustainable manner, of Sierra Leone's contribution to global warming and climate change.	All sectors	• Most of the actions in the NAPA were developed into a bankable project, and progress was monitored and reported through the national communication.
Management of rangelands and pastures by managing grazing systems and grazing intensity, fire management and pasture rehabilitation.	Agriculture and Food Security	• Not Implemented
Integrated management of crops and Livestock management. Strategy	Agriculture and Food Security	• Not Implemented
Restoration of degraded lands with high production potential	Environment	• Development of mined-out area rehabilitation plan for four major mining companies (Sierra Rutile, Koidu Holdings, African Minerals, and London Mining) • 1.2 million seedlings transplanted under the National Tree Planting Project out of a total of 5, million • 100 ha of degraded mangrove sites restored and enhanced in 25 coastal wetland communities.
Management of coastal and fisheries resources through the promotion of non-destructive fishing techniques to maintain resilience of marine ecosystems.	Environment	• Implementing the youth in fisheries project in seven coastal districts, targeting 7,000 youths. • Implementing the West African Regional Fisheries Programme
Promotion and facilitation of early warning and disaster preparedness systems.	Environment	• Installed 8 weather stations across the country through the GEF-funded Climate Information and Early Warning System project. • Installed 8 Agromet stations through the climate-smart agriculture project.

Strengthen the integration of climate change adaptation into the care sector.	Environment	• No action taken
Strengthen the adaptive capacity of the most vulnerable groups and communities through social safety nets and insurance schemes.	Gender and Social Protection Issues	• NaCSA rolling out the social safety net project to 28,538 Households in 10 Districts across the country.
Enhance the resilience of the tourism value chain.	Environment	• Developed the Ecotourism Policy and Action Plan in 2015. • Coastal protection works through the planting of assorted tree species by ecotourism communities, shift from mud or makeshift iron sheet dwellings to brick houses; • Cleaning of coastal beaches and removal of Sargassum Seaweeds as an adaptation strategy. • Ecotourism is enhanced through the construction of Eco-lodges and environmentally friendly facilities in various island communities
Create an enabling environment for the resilience of private sector investment, and demonstrate an operational business case.	All Sector	• Not Implemented
Integrate climate change adaptation into the mining/extractive sector	Hard and soft infrastructure	• Not Implemented
Mainstream climate change adaptation in land reforms.	Environment	• National land policy developed, with provisions for climate change and environment

b) Adaptation strategy

The strategies for climate adaptation across multiple sectors. are rooted in:

- Actions to identify and assess risks, and to manage those risks to minimize the impact
- An understanding that different communities, ecosystems, and sectors are affected differently by climate change and hence, require different plans, including soft, hard, and ecosystem-based
- A consideration of future climate change impacts, as well as those already being experienced
- A phased approach to build flexibility and resilience in planning
- Specific, measurable, achievable, results-oriented, and time-bound objectives that allow a continuous review of the effectiveness, efficiency, equity, and legitimacy of adaptation actions.

Recommendations

The analysis of the SL-BUR1 process enables identified 21 capacity-building needs in four main clusters that aim to facilitate reporting in accordance with the UNFCCC reporting guidelines on BURs/BTRs and participation in ICA in accordance with the ICA modalities and guidelines, taking into account Article 4, paragraph 3, of the Convention. All the capacity-building needs identified during the process are categorized into short-term (January-May 2024), medium-term (June 2024 to August 2025) and long-term (September 2025 to September 2026) categories, with high, medium and low priority. It further identified the following as priority capacity-building needs:

(a) Regarding the capacity-building needs related to MRV, all the needs listed are identified as being of high priority in the short and medium term; mainly:

a. Strengthen institutional arrangements to manage transparency activities;

b. Enhance the capacity of the institutional framework needed for data collection, management and reporting to ensure that the systems to enhance climate transparency in the country are efficient, functional and coordinated;

c. Increase the capacity of institutions to improve the quality and reliability of GHG inventories, particularly on activity data and emission factors of key subsectors, i.e. AFOLU, energy, IPPU and waste;

d. Provide tools and guidelines needed in the remaining sub-systems of the transparency framework, i.e. (1) the MRV system for mitigation actions, (2) the MRV system for the financial support received, (3) the M&E system for adaptation actions;

e. Enhance the capacity of the development of indicators, protocols and mitigation formats for monitoring the NDC and tracking support needed/received;

f. Establish a National Capacity Building System for all matters related to Climate Transparency.

(b) Regarding the capacity-building needs related to GHG inventories, all the needs listed are identified as being of high priority in the short and medium-term; mainly:

g. Enhance the capacity of national institutions and sectoral experts from relevant institutions in data compilation, management, maintenance and archiving of databases, with good practices in knowledge management of GHG data;

h. Increase training of Trainers and subsequently trainees for Data collection, processing, and sharing in prioritized sectors;

i. Encourage the development of data collection tools by the various sectoral teams;

j. Enhance the capacity of national sectoral experts from relevant institutions through refresher courses on the use of the UNFCCC reporting guidelines on BURs and IPCC and EMEP/EEA guidelines for calculating estimates of GHG emissions and

removals on a sector-by-sector basis, including cross-cutting issues (e.g., uncertainty assessments, time series consistency, quality assurance and quality control);

k. Strengthen the capacity of national sectoral experts from relevant institutions to improve methodologies and procedures for gathering relevant AD on the consumption of international aviation and marine bunker fuels;

l. Train the national inventory team on tools for GHG inventories, in particular the inventory software of the 2006 IPCC Guidelines, CGE training materials and relevant UNFCCC decisions;

m. Continuously train GHG experts, especially new experts at the national and international levels;

n. Enhance the capacity of the national network of research institutions to conduct studies, research and assessments, focusing on improving the system for data collection needed for the development of the GHG inventory, and developing data management and archiving systems and country-specific EFs for relevant sectors (e.g., energy, IPPU and AFOLU), including to move to higher-tier estimation methodologies in the case of the most relevant key categories;

o. Enhance the efficiency of the implementation of the QA/QC plan and QA/QC verification activities to minimize errors, ensure better time-series consistency and enhance the accuracy and transparency of the reporting;

p. Enhance the national capacity of experts to develop the GHG inventory for the AFOLU sector, including the development of a land-use matrix in accordance with the requirements set out in the 2006 IPCC Guidelines (the land-use matrix might be based on information generated by a nationwide forest inventory, complemented by a complete inventory of land use of all areas, or based on data acquired through remote sensing techniques and facilitated access to the latest satellite data of land use and land-use mapping);

q. Strengthen the capacity of the National Ozone Unit to achieve more accurate data collection and improve methodologies and procedures for gathering relevant AD on emissions of fluorinated gases (e.g., collecting AD from companies that import, use, dispose of, recover and recycle refrigerants and refrigerant equipment in Sierra Leone).

(b) Regarding the capacity-building needs related to mitigation actions and their effects, they were prioritized as follows:

(i) High priority in the short and medium term:

a. Enhance the capacity of experts to estimate quantitative emission reduction co-benefits of programmes and projects; apply methodologies and assumptions for mitigation actions and report them; apply the relevant tools for assessing the implementation of mitigation actions; and report on progress of implementation and the results achieved;

b. Enhance the capacity of national experts to develop a low-carbon development strategy;

c. Enhance the implementation of the domestic MRV system for mitigation actions and the capacity of institutions for data collection, storage and update;

d. Raise the awareness of institutions so that they mainstream climate change considerations in programme and project development;

e. Establish a collaborative framework between the different institutions to facilitate access to information on the progress of implementation of mitigation-related programmes and projects;

(ii) Medium priority in the medium term:

a. Enhance institutional and expert capacity (such as of the DNA) to document and report on international market mechanisms;

b. Build the capacity of all stakeholders on progress indicators;

(c) Regarding the capacity-building needs relating to cross-cutting issues:

(i) High priority in the short term:

Enhance the capacity of the relevant experts to design and implement the relevant institutional arrangements to facilitate the preparation of NCs and BURs continuously, including approaches to sensitize decision-makers;

(ii) Medium priority in the short, medium and long-term:

Enhance the technical capacity of national experts from the relevant institutions in the preparation of NCs and BURs to facilitate reporting continuously;

(d) Regarding capacity-building in relation to needs and support:

(i) High priority in the short and medium-term:

a. Enhance the capacity of staff and national experts to identify and implement the most appropriate tools for assessing and overcoming gaps and constraints (including constraints related to the collection, collation, classification, documentation and archiving of information on the implementation of activities, measures and programmes that have multiple uses or climate change co-benefits);

b. Enhance the national capacity to implement the domestic MRV system;

c. Enhance the national capacity to establish a collaborative framework to facilitate better coordination between public and private institutions and civil society organizations to enable the collection and documentation of information regarding their needs;

(ii) Medium priority in the medium term:

Enhance national capacity to establish a collaborative framework to facilitate the implementation of a study on technology needs and enable reporting on the technology needs determined at the national level.

Annexes

Technical Annexes to the BUR

Annex I: GHG Inventory

Summary report for GHG emissions inventory

Table 1: GHG inventory - summary report for national GHG inventory

Inventory Year: 2020

Categories	Emissions (Gg)			Emissions CO2 Equivalents (Gg)					Emissions (Gg)				
	Net CO2 (1)(2)	CH4	N2O	HFCs	PFCs	SF6	NF3	Other halogenated gases with CO2 equivalent conversion factors (3)	Other halogenated gases without CO2 equivalent conversion factors (4)	NOx	CO	NMVOCs	SO2
Total National Emissions and Removals	2724,436215	228,5874	0,6554	24,9373	NE	NE	NE	NE	NE	21,6873	342,2596	40,639041	2,6239
1 - Energy	2720,331244	5,608897	0,1482	NO	NO	NO	NO	NO	NO	21,6873	342,2596	40,639041	2,6239
1.A - Fuel Combustion Activities	2720,331244	5,608897	0,1482							21,6873	342,2596	40,639041	2,6239
1.B - Fugitive emissions from fuels	NE	NE	NE							NE	NE	NE	NE
1.C - Carbon dioxide Transport and Storage	NE									NE	NE	NE	NE
2 - Industrial Processes and Product Use	NE	NE	NE	24,9373	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.A - Mineral Industry	NE	NE	NE							NE	NE	NE	NE
2.B - Chemical Industry	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.C - Metal Industry	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.D - Non-Energy Products from Fuels and Solvent Use	NE	NE	NE							NE	NE	NE	NE
2.E - Electronics Industry	NE	NE	NE	0	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NE	NE	NE	24,9373	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.G - Other Product Manufacture and Use	NE	NE	NE	0	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.H - Other	NE	NE	NE	0	NE	NE	NE	NE	NE	NE	NE	NE	NE
3 - Agriculture, Forestry, and Other Land Use	NE	192,0127	0,5033	NO	NO	NO	NO	NO	NO	0	0	0	0
3.A - Livestock		192,0127	0,5033							NE	NE	NE	NE
3.B - Land	NE									NE	NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land	NE	NE	NE							NE	NE	NE	NE
3.D - Other	NE	NE	NE							NE	NE	NE	NE
4 - Waste	4,104971027	30,9658	0,004	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE
4.A - Solid Waste Disposal		4,278181								NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste		NE	NE							NE	NE	NE	NE
4.C - Incineration and Open Burning of Waste	4,104971027	NE	NE							NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge		26,68762	0,004							NE	NE	NE	NE
4.E - Other (please specify)	NE	NE	NE							NE	NE	NE	NE
5 - Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3			0							NE	NE	NE	NE
5.B - Other (please specify)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
Memo Items (5)													
International Bunkers	176,0271203	0,001231	0,0049	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers) (1)	176,0271203	0,001231	0,0049							NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers) (1)	NE	NE	NE							NE	NE	NE	NE
1.A.5.c - Multilateral Operations (1)(2)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE

Sectoral reports of GHG emission inventory

Table 2: Sectoral report for energy

Inventory Year: 2020

	Emissions (Gg)						
Categories	CO2	CH4	N2O	NOx	CO	NMVOCs	SO2
1 - Energy	2720,3312	0,7645	0,0976	21,6873	342,2596	40,639041	2,6239
1.A - Fuel Combustion Activities	2720,3312	0,7645	0,0976	21,6873	342,2596	40,639041	2,6239
1.A.1 - Energy Industries	516,8083	0,0209	0,0042	0,0453	0,112849	0,005573	0,323
1.A.1.a - Main Activity Electricity and Heat Production	516,8083	0,0209	0,0042	0,0453	0,112849	0,005573	0,323
1.A.1.a.i - Electricity Generation	203,9232	0,0083	0,0017	0,0179	0,044582	0,002202	0,127
1.A.1.a.ii - Combined Heat and Power Generation (CHP)	312,8851	0,0127	0,0025	0,0274	0,068267	0,003371	0,196
1.A.1.a.iii - Heat Plants				NO	NO	NO	NO
1.A.1.b - Petroleum Refining				NO	NO	NO	NO
1.A.1.c - Manufacture of Solid Fuels and Other Energy Industries	NE	NE	NE	NO	NO	NO	NO
1.A.1.c.i - Manufacture of Solid Fuels	NE	NE		NO	NO	NO	NO
1.A.1.c.ii - Other Energy Industries				NO	NO	NO	NO
1.A.2 - Manufacturing Industries and Construction	277,33292	0,0112	0,0022	1,92	0,247	0,093568	0,1759
1.A.2.a - Iron and Steel				NO	NO	NO	NO
1.A.2.b - Non-Ferrous Metals				NO	NO	NO	NO
1.A.2.c - Chemicals				NO	NO	NO	NO
1.A.2.d - Pulp, Paper and Print				NO	NO	NO	NO
1.A.2.e - Food Processing, Beverages and Tobacco	277,33292	0,0112	0,0022	1,92	0,247	0,093568	0,1759
1.A.2.f - Non-Metallic Minerals				NO	NO	NO	NO
1.A.2.g - Transport Equipment				NO	NO	NO	NO
1.A.2.h - Machinery				NO	NO	NO	NO
1.A.2.i - Mining (excluding fuels) and Quarrying				NO	NO	NO	NO
1.A.2.j - Wood and wood products				NO	NO	NO	NO
1.A.2.k - Construction				NO	NO	NO	NO
1.A.2.l - Textile and Leather				NO	NO	NO	NO
1.A.2.m - Non-specified Industry				NO	NO	NO	NO
1.A.3 - Transport	1926,19	0,7323	0,0912	17,616	177,614	33,376	1,917
1.A.3.a - Civil Aviation							
1.A.3.a.i - International Aviation (International Bunkers) (1)							
1.A.3.a.ii - Domestic Aviation				NE	NE	NE	NE
1.A.3.b - Road Transportation	1902,1304	0,7301	0,0905	17,356	177,289	33,311	1,841
1.A.3.b.i - Cars	1622,1211	0,7012	0,076	14,404	170,109	31,924	1,002
1.A.3.b.i.1 - Passenger cars with 3-way catalysts				NE	NE	NE	NE
1.A.3.b.i.2 - Passenger cars without 3-way catalysts	1622,1211	0,7012	0,076	14,404	170,109	31,924	1,002
1.A.3.b.ii - Light-duty trucks	243,39734	0,0195	0,0127	2,594	4,897	0,956	0,719
1.A.3.b.ii.1 - Light-duty trucks with 3-way catalysts				NE	NE	NE	NE
1.A.3.b.ii.2 - Light-duty trucks without 3-way catalysts	243,39734	0,0195	0,0127	2,594	4,897	0,956	0,719
1.A.3.b.iii - Heavy-duty trucks and buses	19,062741	0,001	0,001	0,206	0,257	0,051	0,06
1.A.3.b.iv - Motorcycles	17,549183	0,0084	0,0008	0,152	2,026	0,38	0,06
1.A.3.b.v - Evaporative emissions from vehicles				NE	NE	NE	NE

1.A.3.b.vi - Urea-based catalysts				NE	NE	NE	NE
1.A.3.c - Railways				NE	NE	NE	NE
1.A.3.d - Water-borne Navigation	24,059653	0,0023	0,0006	0,26	0,325	0,065	0,076
1.A.3.d.i - International water-borne navigation (International bunkers) (1)							
1.A.3.d.ii - Domestic Water-borne Navigation	24,059653	0,0023	0,0006	0,26	0,325	0,065	0,076
1.A.3.e - Other Transportation	NE	NE	NE	NE	NE	NE	NE
1.A.3.e.i - Pipeline Transport				NE	NE	NE	NE
1.A.3.e.ii - Off-road				NE	NE	NE	NE
1.A.4 - Other Sectors	NE	NE	NE	2,106	164,2858	7,1639	0,208
1.A.4.a - Commercial/Institutional				NE	NE	NE	NE
1.A.4.b - Residential	0	0	0	2,106	164,2858	7,1639	0,208
1.A.4.c - Agriculture/Forestry/Fishing/Fish Farms	NE	NE	NE	NE	NE	NE	NE
1.A.4.c.i - Stationary				NE	NE	NE	NE
1.A.4.c.ii - Off-road Vehicles and Other Machinery				NE	NE	NE	NE
1.A.4.c.iii - Fishing (mobile combustion)				NE	NE	NE	NE
1.A.5 - Non-Specified	NE	NE	NE	NE	NE	NE	NE
1.A.5.a - Stationary				NE	NE	NE	NE
1.A.5.b - Mobile	NE	NE	NE	NE	NE	NE	NE
1.A.5.b.i - Mobile (aviation component)				NE	NE	NE	NE
1.A.5.b.ii - Mobile (water-borne component)				NE	NE	NE	NE
1.A.5.b.iii - Mobile (Other)				NE	NE	NE	NE
1.A.5.c - Multilateral Operations (1)(2)				NO	NO	NO	NO
1.B - Fugitive emissions from fuels	NE	NE	NE	NE	NE	NE	NE
1.B.1 - Solid Fuels	NE	NE	NE	NO	NO	NO	NO
1.B.1.a - Coal mining and handling	NE	NE	NE	NO	NO	NO	NO
1.B.1.a.i - Underground mines	NE	NE	NE	NO	NO	NO	NO
1.B.1.a.i.1 - Mining				NO	NO	NO	NO
1.B.1.a.i.2 - Post-mining seam gas emissions				NO	NO	NO	NO
1.B.1.a.i.3 - Abandoned underground mines	NE			NO	NO	NO	NO
1.B.1.a.i.4 - Flaring of drained methane or conversion of methane to CO2				NO	NO	NO	NO
1.B.1.a.ii - Surface mines	NE	NE	NO	NO	NO	NO	NO
1.B.1.a.ii.1 - Mining				NO	NO	NO	NO
1.B.1.a.ii.2 - Post-mining seam gas emissions				NO	NO	NO	NO
1.B.1.a.ii.3 - Abandoned surface mines	NE	NE		NO	NO	NO	NO
1.B.1.b - Uncontrolled combustion and burning coal dumps				NO	NO	NO	NO
1.B.1.c - Fuel transformation	NE	NE	NE	NO	NO	NO	NO
1.B.1.c.i - Charcoal and Biochar production				NO	NO	NO	NO
1.B.1.c.ii - Coke production				NO	NO	NO	NO
1.B.1.c.iv - Gasification transformation	NE	NE	NE	NO	NO	NO	NO
1.B.2 - Oil and Natural Gas	NE	NE	NE	NE	NE	NE	NE
1.B.2.a - Oil	NE	NE	NE	NE	NE	NE	NE
1.B.2.a.i - Venting				NE	NE	NE	NE
1.B.2.a.ii - Flaring				NE	NE	NE	NE
1.B.2.a.iii - All Other	NE	NE	NE	NE	NE	NE	NE
1.B.2.a.iii.1 - Exploration	NE	NE	NE	NE	NE	NE	NE
1.B.2.a.iii.2 - Production and Upgrading	NE	NE	NE	NE	NE	NE	NE
1.B.2.a.iii.3 - Transport	NE	NE	NE	NE	NE	NE	NE
1.B.2.a.iii.4 - Refining	NE	NE	NE	NE	NE	NE	NE

1.B.2.a.iii.5 - Distribution of oil products	NE	NE	NE	NE	NE	NE	NE
1.B.2.a.iii.6 - Other				NE	NE	NE	NE
1.B.2.b - Natural Gas	NE	NE	NE	NE	NE	NE	NE
1.B.2.b.i - Venting	NE	NE	NE	NE	NE	NE	NE
1.B.2.b.ii - Flaring	NE	NE	NE	NE	NE	NE	NE
1.B.2.b.iii - All Other	NO	NO	NO	NE	NE	NE	NE
1.B.2.b.iii.1 - Exploration				NE	NE	NE	NE
1.B.2.b.iii.2 - Production				NE	NE	NE	NE
1.B.2.b.iii.3 - Processing				NE	NE	NE	NE
1.B.2.b.iii.4 - Transmission and Storage				NE	NE	NE	NE
1.B.2.b.iii.5 - Distribution				NE	NE	NE	NE
1.B.2.b.iii.6 - Other				NE	NE	NE	NE
1.B.3 - Other emissions from Energy Production	NE	NE	NE	NE	NE	NE	NE
1.C - Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO
1.C.1 - Transport of CO2	NO	NO	NO	NO	NO	NO	NO
1.C.1.a - Pipelines	NO			NO	NO	NO	NO
1.C.1.b - Ships	NO			NO	NO	NO	NO
1.C.1.c - Other (please specify)	NO			NO	NO	NO	NO
1.C.2 - Injection and Storage	NO	NO	NO	NO	NO	NO	NO
1.C.2.a - Injection	NO			NO	NO	NO	NO
1.C.2.b - Storage	NO			NO	NO	NO	NO
1.C.3 - Other				NO	NO	NO	NO

	Emissions (Gg)						
Categories	CO2	CH4	N2O	NOx	CO	NMVOCs	SO2
Memo Items (3)							
International Bunkers	176,0271 2	0,001 2	0,004 9	NE	NE	NE	NE
1.A.3.a.i - International Aviation (International Bunkers) (1)	176,0271 2	0,001 2	0,004 9	NE	NE	NE	NE
1.A.3.d.i - International water-borne navigation (International bunkers) (1)				NE	NE	NE	NE
1.A.5.c - Multilateral Operations (1)(2)							
Information Items							
CO2 from Biomass Combustion	0						
CO2 from Biomass Combustion Captured							

Table 3: Sectoral report for industrial processes and product use.

Inventory Year: 2020

Categories	(Gg)			CO2 Equivalents(Gg)					(Gg)				
	CO2	CH4	N2O	HFCs	PFCs	SF6	NF3	Other halogenated gases with CO2 equivalent conversion factors (1)	Other halogenated gases without CO2 equivalent conversion factors (2)	NOx	CO	NMVOCs	SO2
2 - Industrial Processes and Product Use	NE	NE	NE	24,9373126	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.A - Mineral Industry	NE	NO	NO	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE
2.A.1 - Cement production	NE									NE	NE	NE	NE
2.A.2 - Lime production	NE									NE	NE	NE	NE
2.A.3 - Glass Production	NE									NE	NE	NE	NE
2.A.4 - Other Process Uses of Carbonates	NE	NO	NO	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE
2.A.4.a - Ceramics	NE									NE	NE	NE	NE
2.A.4.b - Other Uses of Soda Ash	NE									NE	NE	NE	NE
2.A.4.c - Non Metallurgical Magnesia Production	NE									NE	NE	NE	NE
2.A.4.d - Other (please specify) (3)	NE									NE	NE	NE	NE
2.A.5 - Other (please specify) (3)										NE	NE	NE	NE
2.B - Chemical Industry	NE	NE	NE	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE
2.B.1 - Ammonia Production	NE									NE	NE	NE	NE
2.B.2 - Nitric Acid Production			NE							NE	NE	NE	NE
2.B.3 - Adipic Acid Production			NE							NE	NE	NE	NE
2.B.4 - Caprolactam, Glyoxal and Glyoxylic Acid Production			NE							NE	NE	NE	NE
2.B.5 - Carbide Production	NE	NE								NE	NE	NE	NE
2.B.6 - Titanium Dioxide Production	NE									NE	NE	NE	NE
2.B.7 - Soda Ash Production	NE									NE	NE	NE	NE
2.B.8 - Petrochemical and Carbon Black Production	NE	NE	NO	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE
2.B.8.a - Methanol	NE	NE								NE	NE	NE	NE
2.B.8.b - Ethylene	NE	NE								NE	NE	NE	NE
2.B.8.c - Ethylene Dichloride and Vinyl Chloride Monomer	NE	NE								NE	NE	NE	NE
2.B.8.d - Ethylene Oxide	NE	NE								NE	NE	NE	NE
2.B.8.e - Acrylonitrile	NE	NE								NE	NE	NE	NE
2.B.8.f - Carbon Black	NE	NE								NE	NE	NE	NE
2.B.9 - Fluorochemical Production	NO	NO	NO	NE	NO	NO	NO	NO	NO	NE	NE	NE	NE
2.B.9.a - By-product emissions (4)				NE						NE	NE	NE	NE
2.B.9.b - Fugitive Emissions (4)										NE	NE	NE	NE
2.B.10 - Other (Please specify) (3)										NE	NE	NE	NE
2.C - Metal Industry	NE	NE	NE	NE	NE	NE	NE	NO	NO	NE	NE	NE	NE
2.C.1 - Iron and Steel Production	NE	NE								NE	NE	NE	NE
2.C.2 - Ferroalloys Production	NE	NE								NE	NE	NE	NE
2.C.3 - Aluminium production	NE				NE					NE	NE	NE	NE
2.C.4 - Magnesium production (5)	NE					NE				NE	NE	NE	NE
2.C.5 - Lead Production	NE									NE	NE	NE	NE
2.C.6 - Zinc Production	NE									NE	NE	NE	NE
2.C.7 - Other (please specify) (3)										NE	NE	NE	NE
2.D - Non-Energy Products from Fuels and Solvent Use (6)	NE	NO	NO	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE
2.D.1 - Lubricant Use	NE									NE	NE	NE	NE
2.D.2 - Paraffin Wax Use	NE									NE	NE	NE	NE
2.D.3 - Solvent Use (7)										NE	NE	NE	NE
2.D.4 - Other (please specify) (3), (8)										NE	NE	NE	NE
2.E - Electronics Industry	0	0	0	0	0	0	0	0	0	NE	NE	NE	NE
2.E.1 - Integrated Circuit or Semiconductor (9)				NE	NE	NE			NE	NE	NE	NE	NE
2.E.2 - TFT Flat Panel Display (9)				NE	NE	NE			NE	NE	NE	NE	NE
2.E.3 - Photovoltaics (9)				NE	NE	NE			NE	NE	NE	NE	NE
2.E.4 - Heat Transfer Fluid (10)					NE					NE	NE	NE	NE
2.E.5 - Other (please specify) (3)										NE	NE	NE	NE

Inventory Year: 2020

Categories	(Gg)			CO2 Equivalents(Gg)					(Gg)				
	CO2	CH4	N2O	HFCs	PFCs	SF6	NF3	Other halogenated gases with CO2 equivalent conversion factors (1)	Other halogenated gases without CO2 equivalent conversion factors (2)	NOx	CO	NMVOCs	SO2
2.F - Product Uses as Substitutes for Ozone Depleting Substances	NO	NO	NO	24,9373126	NE	NO	NO	NO	0	NE	NE	NE	NE
2.F.1 - Refrigeration and Air Conditioning	NO	NO	NO	24,9373126	NE	NO	NO	NO	0	NE	NE	NE	NE
2.F.1.a - Refrigeration and Stationary Air Conditioning				24,9373126	NE				NE	NE	NE	NE	NE
2.F.1.b - Mobile Air Conditioning				NE	NE				NE	NE	NE	NE	NE
2.F.2 - Foam Blowing Agents				NE	NE				NE	NE	NE	NE	NE
2.F.3 - Fire Protection				NE						NE	NE	NE	NE
2.F.4 - Aerosols				NE						NE	NE	NE	NE
2.F.5 - Solvents				NE	NE				NE	NE	NE	NE	NE
2.F.6 - Other Applications (please specify) (3)										NE	NE	NE	NE
2.G - Other Product Manufacture and Use	NO	NO	NO	NO	NE	NE	NO	NO	NO	NE	NE	NE	NE
2.G.1 - Electrical Equipment	NO	NO	NO	NO	NE	NE	NO	NO	NO	NE	NE	NE	NE
2.G.1.a - Manufacture of Electrical Equipment					NE	NE				NE	NE	NE	NE
2.G.1.b - Use of Electrical Equipment					NE					NE	NE	NE	NE
2.G.1.c - Disposal of Electrical Equipment					NE					NE	NE	NE	NE
2.G.2 - SF6 and PFCs from Other Product Uses	NO	NO	NO	NO	NE	NE	NO	NO	NO	NE	NE	NE	NE
2.G.2.a - Military Applications					NE					NE	NE	NE	NE
2.G.2.b - Accelerators					NE					NE	NE	NE	NE
2.G.2.c - Other (please specify) (3)					NE	NE				NE	NE	NE	NE
2.G.3 - N2O from Product Uses	NO	NO	NE	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE
2.G.3.a - Medical Applications										NE	NE	NE	NE
2.G.3.b - Propellant for pressure and aerosol products										NE	NE	NE	NE
2.G.3.c - Other (Please specify) (3)			NE							NE	NE	NE	NE
2.G.4 - Other (Please specify) (3)										NE	NE	NE	NE
2.H - Other	NE	NO	NO	NO	NO	NO	NO	NO	NO	NE	NE	NE	NE
2.H.1 - Pulp and Paper Industry	NE									NE	NE	NE	NE
2.H.2 - Food and Beverages Industry	NE									NE	NE	NE	NE
2.H.3 - Other (please specify) (3)										NE	NE	NE	NE

Table 4: Sectoral report for agriculture, forestry, and other land uses (AFOLU)

Inventory Year: 2020

Categories	(Gg)					
	Net CO2 emissions / removals	Emissions				
		CH4	N2O	NOx	CO	NMVOCs
3 - Agriculture, Forestry, and Other Land Use	NE	192,0127	0,503	NE	NE	NE
3.A - Livestock	NO	192,012	0,503	NE	NE	NE
3.A.1 - Enteric Fermentation	NO	182,879	0	NE	NE	NE
3.A.1.a - Cattle	NO	85,839	0	NE	NE	NE
3.A.1.a.i - Dairy Cows		85,839		NE	NE	NE
3.A.1.a.ii - Other Cattle		0		NE	NE	NE
3.A.1.b - Buffalo		0		NE	NE	NE
3.A.1.c - Sheep		36,564		NE	NE	NE
3.A.1.d - Goats		59,52699		NE	NE	NE
3.A.1.e - Camels		0		NE	NE	NE
3.A.1.f - Horses		0		NE	NE	NE
3.A.1.g - Mules and Asses		0		NE	NE	NE
3.A.1.h - Swine		0,950		NE	NE	NE
3.A.1.j - Other (please specify)		0		NE	NE	NE
3.A.2 - Manure Management (1)	NO	9,133	0,503	NE	NE	NE
3.A.2.a - Cattle	NO	1,866	0,503	NE	NE	NE
3.A.2.a.i - Dairy cows		1,866	0,503	NE	NE	NE
3.A.2.a.ii - Other cattle		0	NE	NE	NE	NE
3.A.2.b - Buffalo		0	NE	NE	NE	NE
3.A.2.c - Sheep		1,463	NE	NE	NE	NE
3.A.2.d - Goats		2,619	NE	NE	NE	NE
3.A.2.e - Camels		0	NE	NE	NE	NE
3.A.2.f - Horses		0	NE	NE	NE	NE
3.A.2.g - Mules and Asses		0	NE	NE	NE	NE
3.A.2.h - Swine		0,950	NE	NE	NE	NE
3.A.2.i - Poultry		2,236	NE	NE	NE	NE
3.A.2.j - Other (please specify)		0	NE	NE	NE	NE
3.B - Land	NE	NE	NE	NE	NE	NE
3.B.1 - Forest land	NE	NE	NE	NE	NE	NE
3.B.1.a - Forest land Remaining Forest land	NE			NE	NE	NE
3.B.1.b - Land Converted to Forest land	NE	NE	NE	NE	NE	NE
3.B.1.b.i - Cropland converted to Forest Land	NE			NE	NE	NE
3.B.1.b.ii - Grassland converted to Forest Land	NE			NE	NE	NE
3.B.1.b.iii - Wetlands converted to Forest Land	NE			NE	NE	NE
3.B.1.b.iv - Settlements converted to Forest Land	NE			NE	NE	NE
3.B.1.b.v - Other Land converted to Forest Land	NE			NE	NE	NE
3.B.2 - Cropland	NE	NE	NE	NE	NE	NE
3.B.2.a - Cropland Remaining Cropland	NE			NE	NE	NE
3.B.2.b - Land Converted to Cropland	NE	NE	NE	NE	NE	NE

3.B.2.b.i - Forest Land converted to Cropland	NE			NE	NE	NE
3.B.2.b.ii - Grassland converted to Cropland	NE			NE	NE	NE
3.B.2.b.iii - Wetlands converted to Cropland	NE			NE	NE	NE
3.B.2.b.iv - Settlements converted to Cropland	NE			NE	NE	NE
3.B.2.b.v - Other Land converted to Cropland	NE			NE	NE	NE
3.B.3 - Grassland	NE	NE	NE	NE	NE	NE
3.B.3.a - Grassland Remaining Grassland	NE			0	0	0
3.B.3.b - Land Converted to Grassland	NE	NE	NE	NE	NE	NE
3.B.3.b.i - Forest Land converted to Grassland	NE			NE	NE	NE
3.B.3.b.ii - Cropland converted to Grassland	NE			NE	NE	NE
3.B.3.b.iii - Wetlands converted to Grassland	NE			NE	NE	NE
3.B.3.b.iv - Settlements converted to Grassland	NE			NE	NE	NE
3.B.3.b.v - Other Land converted to Grassland	NE			NE	NE	NE
3.B.4 - Wetlands	NE	NE	NE	NE	NE	NE
3.B.4.a - Wetlands Remaining Wetlands	NE	NE	NE	NE	NE	NE
3.B.4.a.i - Peat Extraction remaining Peat Extraction	NE			NE	NE	NE
3.B.4.a.ii - Flooded Land remaining Flooded Land				NE	NE	NE
3.B.4.a.iii - Other Wetlands Remaining Other Wetlands	NE			NE	NE	NE
3.B.4.b - Land Converted to Wetlands	NE	NE	NE	NE	NE	NE
3.B.4.b.i - Land converted for Peat Extraction	NE			NE	NE	NE
3.B.4.b.ii - Land converted to Flooded Land	NE			NE	NE	NE
3.B.4.b.iii - Land converted to Other Wetlands	NE			NE	NE	NE
3.B.5 - Settlements	NE	NE	NE	NE	NE	NE
3.B.5.a - Settlements Remaining Settlements	NE			NE	NE	NE
3.B.5.b - Land Converted to Settlements	NE	NE	NE	NE	NE	NE
3.B.5.b.i - Forest Land converted to Settlements	NE			NE	NE	NE
3.B.5.b.ii - Cropland converted to Settlements	NE			NE	NE	NE
3.B.5.b.iii - Grassland converted to Settlements	NE			NE	NE	NE
3.B.5.b.iv - Wetlands converted to Settlements	NE			NE	NE	NE
3.B.5.b.v - Other Land converted to Settlements	NE			NE	NE	NE
3.B.6 - Other Land	NE	NE	NE	NE	NE	NE
3.B.6.a - Other land Remaining Other land				NE	NE	NE
3.B.6.b - Land Converted to Other land	NE	NE	NE	NE	NE	NE
3.B.6.b.i - Forest Land converted to Other Land	NE			NE	NE	NE
3.B.6.b.ii - Cropland converted to Other Land	NE			NE	NE	NE
3.B.6.b.iii - Grassland converted to Other Land	NE			NE	NE	NE
3.B.6.b.iv - Wetlands converted to Other Land	NE			NE	NE	NE
3.B.6.b.v - Settlements converted to Other Land	NE			NE	NE	NE
3.C - Aggregate sources and non-CO2 emissions sources on land (2)	NE	NE	NE	NE	NE	NE
3.C.1 - Burning	NE	NE	NE	NE	NE	NE
3.C.1.a - Burning in Forest Land	NE	NE	NE	0	0	NE
3.C.1.b - Burning in Cropland	NE	NE	NE	0	0	NE
3.C.1.c - Burning in Grassland	NE	NE	NE	0	0	NE
3.C.1.d - Burning in All Other Lands	NE	NE	NE	0	0	NE
3.C.2 - Liming	NE			NE	NE	NE

3.C.3 - Urea application	NE			NE	NE	NE
3.C.4 - Direct N2O Emissions from managed soils (3)			NE	NE	NE	NE
3.C.5 - Indirect N2O Emissions from managed soils			NE	NE	NE	NE
3.C.6 - Indirect N2O Emissions from manure management			NE	NE	NE	NE
3.C.7 - Rice cultivation		NE		NE	NE	NE
3.C.8 - CH4 from Drained Organic Soils		NE		NE	NE	NE
3.C.9 - CH4 from Drainage Ditches on Organic Soils		NE		NE	NE	NE
3.C.10 - CH4 from Rewetting of Organic Soils		NE		NE	NE	NE
3.C.11 - CH4 Emissions from Rewetting of Mangroves and Tidal Marshes		NE		NE	NE	NE
3.C.12 - N2O Emissions from Aquaculture			NE	NE	NE	NE
3.C.13 - CH4 Emissions from Rewetted and Created Wetlands on Inland Wetland Mineral Soils		NE		NE	NE	NE
3.C.14 - Other (please specify)				NE	NE	NE
3.D - Other	NE	NE	NE	NE	NE	NE
3.D.1 - Harvested Wood Products	NE			NE	NE	NE
3.D.2 - Other (please specify)				NE	NE	NE

Table 5: Sectoral report for waste

Inventory Year: 2020

Categories	Emissions [Gg]						
	CO2	CH4	N2O	NOx	CO	NMVOCs	SO2
4 - Waste	4,104971027	30,96580075	0,003952258	NE	NE	NE	NE
4.A - Solid Waste Disposal	NE	4,278181307	NE	NE	NE	NE	NE
4.A.1 - Managed Waste Disposal Sites		1,692805553		NE	NE	NE	NE
4.A.2 - Unmanaged Waste Disposal Sites		2,031366664		NE	NE	NE	NE
4.A.3 - Uncategorised Waste Disposal Sites		0,55400909		NE	NE	NE	NE
4.B - Biological Treatment of Solid Waste		NE	NE	NE	NE	NE	NE
4.C - Incineration and Open Burning of Waste	4,104971027	NE	NE	NE	NE	NE	NE
4.C.1 - Waste Incineration	NE	NE	NE	NE	NE	NE	NE
4.C.2 - Open Burning of Waste	4,104971027	NE	NE	NE	NE	NE	NE
4.D - Wastewater Treatment and Discharge	0	26,68761944	0,003952258	NE	NE	NE	NE
4.D.1 - Domestic Wastewater Treatment and Discharge		26,68761944	0,003952258	NE	NE	NE	NE
4.D.2 - Industrial Wastewater Treatment and Discharge		NE	NE	NE	NE	NE	NE
4.E - Other (please specify)				NE	NE	NE	NE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