SEYCHELLES

FIRST

BIENNAL UPDATE REPORT (BUR)

UNDER THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

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AD	Activity Data
AF	Adaptation Fund
AFOLU	Agriculture, Forestry and Land use
Art	Article
Avgas	Aviation gasoline
AWMS	Animal Waste Management System
BAU	Business as Usual
BOD	Biochemical Oxygen Demand
BUR1	First Biennial Update Report
CAEP	Climate Action Enhancement Package
CAMS	Climate Adaptation and Mitigation Section
CCA	Climate Change Adaptation
CCADP	Comprehensive Africa Agriculture Development Programme
CBD	Convention on Biological Diversity
CCD	Climate Change Division
CCS	Carbon dioxide capture and storage
CH_4	Methane
CHP	Combined Heat and Power Generation
CL	Communal lands
CLA	Crop and Livestock Assessments
CO_2	Carbon dioxide
CO_2eq	Carbon dioxide equivalent
COD	Chemical Oxygen Demand
COP	Conference of Parties
Corinair	Core Inventory of Air Emissions
CSO	Civil Society Organization
COVID-19	Coronavirus Disease
DECC	Department of Energy and Climate Change
DRMD	Disaster Risk Management Division
dm	Dry matter
DOC	Degradable Organic Carbon
EBA	Ecosystem-based Adaptation
EEZ	Exclusive Economic Zone
EF	Emission factor
EFDB	Emission Factor Data Base
EMP	Electricity Master Plan
ETF	Enhanced Transparency Framework
EU	European Union
EVs	Electric Vehicles
FAO	Food and Agriculture Organisation of the United Nations
FOD	First Order Decay
GCCA	Global Climate Change Alliance
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
Gg	Gigagrams
GHG	Greenhouse gas
GoS	Government of Seychelles
GPG	Good Practice Guidelines
GWP	Global Warming Potential

HAC	High Activity Clay
IEA	International Energy Agency
IMF	International Monetary Fund
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate change
IPPU	Industrial Processes and Produce Use
IRENA	International Renewable Energy Agency
ISA	International Solar Alliance
ISIC	International Standard Industrial Classification
JICA	Japan International Corporation Agency
Kt	Kilotonne
LAC	Low Activity Clay
LEG	Least Developed Country Expert Group
LPG	Liquefied Petroleum Gas
LTOs	Landing and Take Offs
MACCE	Ministry of Agriculture, Climate Change and Environment
MAT	Mean Annual Temperature
MCF	Methane Correction Factor
MEECC	Ministry of Environment, Energy and Climate Change
MIC	Manufacturing Industries and Construction
MMR	Monitoring Mechanism Regulation
MJ	Megajoule
MPA	Marine Protected Area
MRV	Measurements, Reporting and Verification
MSP	Marine Spatial Plan
MSWDs	Municipal Solid Waste Disposal Site
mt	metric tonnes
MW	MegaWatts
NAMAs	Nationally Appropriate Mitigation Actions
NAP	National Adaptation Plan
NBS	National Bureau of Statistics
NBSAP	National Biodiversity Strategic Action Plan
NCCC	National Climate Change Council
NCCP	National Climate Change Policy
NCCS	National Climate Change Strategy
NCSA	National Capacity Self-Assessment
N_2O	Nitrous oxide
NCVs	Net Calorific Values
NDC	Nationally Determined Contribution
NDS	National Development Strategy
NE	Not Estimated
NFNSP	National Food and Nutrition Security Policy
NIHSS	National Institute of Health and Social Studies
NIR	National Inventory Report
NMVOCs	Non-methane Volatile Organic Carbons
NO	Not Occurring
NOx	Oxides of nitrogen
ODS	Ozone Depleting Substances
PA	Paris Agreement
PMU	Project Management Unit
PSC	Project Steering Committee
PUC	Public Utility Corporation
PV	Photovoltaics

QA	Quality Assurance
QC	Quality Control
RE	Renewable Energy
SCR	Seychelles Rupees
SEC	Seychelles Energy Commission
SDGs	Sustainable Development Goals
SLTA	Seychelles Land Transport Agency
S4S	Sustainability for Seychelles
SNAIP	Seychelles National Agricultural Investment Plan
SNC	Second National Communication
SO2	Sulphur Oxide
SeyCCAT	Seychelles Conservation and Climate Adaptation Trust
SEYPEC	Seychelles Petroleum Company Limited
SFA	Seychelles Fishing Authority
SIDS	Small Island Developing State
SPTC	Seychelles Public Transport Corporation
SSDS	Seychelles Sustainable Development Strategy
SYAH	Seychelles Youth Aims Hub
TACCC	Transparent, accurate, consistent, comparable and complete
TJ	TerraJoules
TNA	Technology Needs Assessment
TNC	The Nature Conservancy
TNC	Third National Communication
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNSD	United Nations Statistics Division
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

The Seychelles' First Biennial Update Reports (FBURs) have been prepared as an extension of the Third National Communication. The BUR, per the United Nations Framework Convention on Climate Change (UNFCCC), are reports to be submitted by non-Annex I Parties, of which Seychelles falls within this category. This report contains updates on national Greenhouse Gas (GHG) inventories, including a national inventory report and information on mitigation actions, needs, and support received. More importantly, the FBUR provides an update on actions undertaken by Seychelles to implement the convention, including the status of its GHG emissions and removals by sinks, as well as on the actions to reduce emissions or enhance sinks.

For comprehensive reporting and in alignment with the objectives of the convention, the Seychelles BUR is organized into six chapters as follows: Chapter 1 – national circumstances and institutional arrangement; Chapter 2 – greenhouse gas inventory; Chapter 3 – mitigation actions and their effects; chapter 4 – measurement, reporting, and verification (MRV); chapter 5 – constraints and gaps and related financial, technical and capacity needs and supports received; and chapter 6 – any other relevant information.

Chapter 1 – National circumstances and institutional arrangement

The archipelago comprises 115 islands occupying a land mass of 455 square kilometers and an Exclusive Economic Zone (EEZ) covering 1.374 million square kilometers. Of these islands, 42 are granitic, and the rest are of coralline origin. The main granitic islands, also known as the inner islands, are Mahé, Praslin, Silhouette, and La Digue, in descending order of size. The granitic group of islands is all within a 56-kilometer radius of the main island of Mahe. These islands are rocky; most have a narrow coastal strip and a central range of hills rising as high as 905 meters. Mahe is the largest island, 9,142 square kilometers, and hosts the capital, Victoria. The coral islands are flat, with elevated coral reefs at different stages of formation.

In 2019, the population estimate of Seychelles stood at 98,055 and is projected to reach 104,000 by 2030. With a literacy rate of 97% and a high average life expectancy of 74 years, Seychelles enjoys a high quality of life despite the challenges of being a Small Island Developing State (SIDS). The bulk of the population, economic activities, and other forms of development are concentrated mainly on the narrow coastal strips of the three main granitic islands of Mahe, Praslin, and La Digue. Mahe, in particular, has about 87% of the total population, with some 40% located on the east coast in a belt of 7 km by 1 km to the south of the capital, Victoria.

Seychelles depends on climate-sensitive livelihood activities such as tourism, fisheries, and agriculture. Tourism, fisheries, and offshore financial activities are the central stimulants of economic growth. However, the economy's high dependence on tourism for foreign exchange earnings leaves the external account vulnerable to developments in major tourist markets, such as the European Union and, increasingly, China.

In 2018, tourist arrivals rose by 3 percent from 2017, directly contributing 23.2 percent of total GDP. In 2019, tourist arrivals grew by 6 percent, contributing to a forecasted 24 percent of total

GDP. However, the impact of the COVID-19 pandemic eroded all the gains achieved during the previous years, highlighting the vulnerability of Seychelles' economy. The fishery sector locally also benefits from the tourism establishments, and the livelihood of fishers was also impacted during the lockdown driven by the COVID-19 pandemic. On the other hand, agricultural production contributes less than 3% of the country's GDP, and over 80% of the food consumed locally is imported.

Another vital pillar of the Seychelles economy is the financial sector, the most dynamic sector with a growing selection of financial products and services. One of the critical factors leading to the country's ascent into the global financial services scene has been its success in creating a legal framework that is sound, reliable, and attractive to investors. In 2017, the Central Bank of Seychelles (CBS) developed and launched a National Financial Education Strategy (NFES), which is intended to improve the level of financial capability of Seychellois, thereby facilitating further development of the financial sector, accumulation of assets, and economic growth.

Chapter 2 – Greenhouse gas inventory

Seychelles is a party to the United Nations Framework Convention on Climate Change (UNFCCC). Seychelles is expected to develop, publish, and regularly update the national greenhouse gas (GHG) emissions inventory as part of its obligations under the Convention. As a non-Annex I Party to the Convention, decisions 1/CP.16 paragraphs 60(a-c) request that the GHG inventory be communicated via the National Communication (every four years) and the Biennial Update Report (every two years). National Communications (NCs) and Biennial Update Reports (BURs) are reports that each Party to the UNFCCC prepares periodically per the guidelines developed and adopted by the Conference of Parties to the UNFCCC. With grant support from the Global Environmental Facility (GEF) through the United Nations Environment Programme (UNEP), the Ministry of Agriculture, Climate Change and Environment (MACCE) has undertaken an exercise to prepare its First Biennial Update Report (FBUR) under decision 2/CP17 of the UNFCCC.

To report on the actions undertaken to implement the Convention, including the status of its GHG emissions and removals by sinks, as well as on the actions to reduce emissions or to enhance sinks, Seychelles has prepared its second National Inventory Report (NIR) to accompany its submission of the first Biennial Update Report (FBUR), which contains updated accounts of net GHG emissions estimates for the period 2000 – 2020 from four major economic sectors: Energy; Industrial Processes and Product Use (IPPU); Agriculture, Forestry and Other Land Use (AFOLU); and Waste. The GHGs estimated in this inventory are carbon dioxide (CO_2), methane (CH_4), Nitrous Oxide (N_2O), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). Emissions for each of the direct greenhouse gases have been presented in carbon dioxide equivalent (CO_2e) terms, using the 100-year global warming potentials (GWPs) contained in the IPCC Fourth Assessment Report (AR4) (2007).

The NIR has been prepared following the UNFCCC BUR guidelines for non-Annex I Parties (decision 2/CP.17 and its annex III). The GHG emissions estimates provided in this report have been compiled per the Intergovernmental Panel on Climate Change (IPCC) 2006 Guidelines for National Greenhouse Gas Inventories (IPCC 2006) and the 2019 Refinement to the 2006 IPCC

Guidelines for National Greenhouse Gas Inventories (IPCC 2019) as reference. The purpose of the Guidelines was to ensure that GHG emissions estimates were transparent, accurate, consistent, comparable, and complete (TACCC) through time and comparable with inventories produced in other countries of similar national circumstances. The estimates in this report form part of Seychelles' FBUR and will be the subject of future international technical assessment as required under the international consultation and analysis (ICA) process. This is consistent with the modalities and guidelines for ICA (decision 2/CP.17 and annex IV).

The NIR and the preparation process are not only intended to serve international reporting obligations but also offer significant benefits, including:

- Building capacity for nominated national experts and key stakeholders through the process of compiling the GHG inventory and associated data;
- Improving access to a consolidated evidence base to inform policy development for low carbon development pathways;
- Building a solid foundation and baseline for GHG projections, national emissions reduction targets, and GHG mitigation scenarios.

Summary of national GHG emission and removal estimates and trends

Seychelles' net GHG emissions in 2020 were estimated at 558.60 Gg CO_2e. The estimate was down from 2019 (609.38 Gg CO_2e) following the impact of COVID-19, with 77 % of emissions in 2020 coming from the Energy sector, the AFOLU sector contributed 13 %, the Waste sector contributed 8% of emissions, and IPPU contributed the remaining 2 % (Figure 1). Seychelles' total GHG emissions have steadily risen since 2000 (Figure 2), primarily driven by increasing emissions from the Energy sector. The leading causes for increasing emissions in this sector stem from electricity power generation and the road transportation sub-sectors. The second most significant sector was the AFOLU sector, which increased over time due to increased forest clearing for infrastructure development. Overall, the total GHG emissions increased across the time series at 272.83 Gg CO_2e in 2000, 596.80 Gg CO_2e in 2018, and a 53.61 % increase in 2020.

Overview of source and sink estimates and trends by gas

Seychelles' net GHG emissions across the time series 2000-2020 were dominated by CO_2 releases (83%), followed by CH_4 (8%), N_2O (0.6%), and F-gases (5%), with 4% CO_2 removals. Since 2000, CO_2 has been the most important GHG in Seychelles in terms of contribution to the national total, the bulk of which originated from the energy sector. The waste sector dominated methane emissions and showed an increasing trend between 2000-2020. However, there was a decrease in N_2O across the time series. This changing dynamic was primarily due to the decreasing influence of the agricultural sector in Seychelles, which was attributed to the reduced application of fertilizers to soils. The release of F-gases has steadily increased due to the use of air conditioning since 2000, but their relative share of total GHG emissions has remained small.

Chapter 3 – Mitigation actions and their effects

As per the guidance established by Decision 2/CP17, Annex III, this report provides information on the actions by Seychelles to mitigate climate change by addressing anthropogenic emissions.

Mitigation actions are not limited to those communicated officially to the United Nations Framework Convention on Climate Change (UNFCCC) and compiled in document FCCC/SBI/2013/INF.12/Rev.2. However, the Nationally Appropriate Mitigation Actions (NAMAs) that were initially communicated under the Copenhagen Accord already cover an extensive range of different approaches and types of actions that can be envisioned.

Depending on the focus of the analysis, mitigation actions can be grouped in different ways. The most common classifications are by:

- Type of action: here, the main question is what type of action is the focus of the mitigation action, i.e., which instruments are used as mitigation actions;
- Scope: another dimension is the coverage of the mitigation action by sector, geography, or technology;
- Source of funding: if the source of financing is the dominant question, a different classification will result.

Different classifications of mitigation actions will be suitable depending on which of these categories or combinations of categories are explored. The subsequent section details the various approaches to differentiating the mitigation actions mentioned above.

As per the 2021 NDC and based on current projections, Seychelles aims to reduce overall GHG emissions by 26.4% in 2030 compared to Business as Usual (BAU) (equivalent to around 293.8 ktCO2eq of avoided emissions). Compared to the 2015 INDC target of 188ktCO2eq GHG emissions reduction, the mitigation ambition of the Seychelles is significantly enhanced. The mitigation actions provided are per the commitments in the Seychelles' Nationally Determined Contribution submitted in 2021. In addition, Seychelles has committed to achieving a decarbonized net-zero emission economy by 2050.

This report provides the details concerning mitigation actions for the Seychelles in the 4 IPCC sector categories: energy sector (including transport) and non-energy sectors (Industrial Processes and Product Use (IPPU); waste; Agriculture, Forestry, and Other Land Use (AFOLU)).
Additionally, Seychelles' enhanced mitigation contributions include the following:

- The 2030 commitment to reduce economy-wide GHG emissions by 26.4% below business-as-usual (BAU);

- The long-term commitment to achieve a decarbonized economy by 2050 and to boost electricity generation from renewable energies, including marine energy technologies, bio-energies, such as biomass and waste-to-energy, and the use of environment-friendly intermittent energy storage technologies;
- The 2030 commitment to shift progressively to low-carbon transport, including active modes and international maritime transport, starting with public transportation;
- The 2030 commitment to use renewable energy (RE) for water supply mobilization and to secure a sustainable and resilient water management system;
- The 2030 commitment to ensure that sewage systems and wastewater treatment facilities include nutrients and energy recovery;
- The commitment to ensuring Responsible Tourism in a circular economy, defining a 2030 target of reducing GHG emissions from the sector.

Chapter 4 – Measurement, reporting, and verification (MRV)

An institutional arrangement has to be developed to integrate the MRV system into the organizational structure of the Seychelles Government (GoS). Such an organizational structure will ensure precise assignment of roles and responsibilities, adequate capacity and human resources, and a smooth connection and regular exchange of information between the administrations/institutions and key stakeholders involved in MRV activities.

In this context, a sustained institutional arrangement for the Biennial Update Reports is proposed to create an appropriate working framework. This working framework should cover the management and coordination of the parties involved in the MRV system. In addition, sectoral experts should be part of the working framework to provide technical knowledge and data. The Climate Change Department and National Climate Change Committee will coordinate the preparation of greenhouse gas inventories to monitor and control emissions in various vital sectors.

For the data request, it is necessary to sign a Memorandum of Understanding and Confidentiality Agreement (CA) with the data provider. A template for the CA and MoU is reported in the United States of America's Environment Protection Agency (US EPA) templates.

Before and during the input of the data collected in the Inventory software, it is necessary to gather and report as much information as possible on the data collected, such as the contact details of the data provider, methodology used, data processing methodologies (if applicable), calculations, assumptions (if any), recalculations (if any), etc. All this information should be collected as described in the US EPA templates. It is also crucial at this stage to consider the quality Assurance/Quality Control (QA/QC) procedures during the data collection. To that end, the QA/QC procedure proposal is reported in US EPA templates.

As Seychelles moves towards more frequent reporting in the form of BTRs and the upcoming Fourth National Communication (FNC), there is a greater need for institutional continuity and systematic procedures, including deeper engagement with civil society and the private sector. There is a pressing need to build internal capacities for data collection and GHG estimation to improve data supply and quality.

A Measuring, Reporting, and Verification (MRV) system is required for GHG mitigation/sequestration actions to support NAMAs and the regular submission of BTRs.
There is no completed formal recording system for tracking mitigation actions within the Seychelles' institutions, which would be used to conveniently report on the status and the progress of activities implemented. Nevertheless, Seychelles is developing a framework to cater to MRV approaches for individual mitigation actions. Two vital considerations for developing this framework include:

a) a uniform process;
b) a common sectoral assumption to provide comparability with existing projections.

Chapter 5 – Constraints and gaps and related financial, technical, and capacity needs and supports received

For Seychelles to meet its obligations made to the Conference of Parties (COP) regarding its reporting requirements under the United Nations Framework Convention on Climate Change (UNFCCC) concerning the National Communications (NC) and the Biennial Update Report (BUR), it needs further and continuous support in i) consolidating the existing technical capacity level it has reached, ii) consolidating and improving the institutional framework in place, iii) integrating Climate Change in all aspects of socio-economic development.

With the full implementation of the Paris Agreement (PA) in 2020 and the enhanced transparency framework that Non-Annex 1 countries must adhere to, Seychelles has to reassess its needs continuously to ensure it aligns with local realities and global commitments.
From its ascension to the UNFCCC in 1992, Seychelles has implemented several Climate Change Activities to meet the convention's requirements.

These enhanced requirements from the UNFCCC involve new methodologies and approaches that require countries to have the technical expertise to implement the agreements. A Small Island Developing State (SIDS) like Seychelles needs to be able to retain its small pool of experts to continuously develop and upgrade its technical capacity to achieve its obligations to the convention as well as its Greenhouse Gas (GHG) emissions reduction goals and targets in the short to medium term.

Over the last decade, Seychelles has implemented multiple Climate Change (CC) projects and activities with the assistance of numerous international donors, primarily through grant financing. These funding opportunities have been made possible through multilateral and bilateral agreements. Because of its small size and limited capacity, Seychelles has to constantly seek international assistance in financial, capacity building, technical, and technological transfer in the short to medium term.

Access to climate financing is critical to national climate actions, reporting requirements, and implementing the convention's agreement. Reporting to and compliance with the COP is becoming more frequent and a standard to meet the Enhanced Transparency Framework (ETF) of the Paris Agreement (PA). Funding from the GEF for the BUR and other reporting requirements is still the central overall budget that Seychelles uses for the reporting. Development, approval, disbursement, and preparing the BUR are lengthy. The fund has to be in sync with the country's reporting schedules. As mentioned previously, an effective Measurement, Reporting, and Verification (MRV) system for the Seychelles would make this process more efficient in tracking the funding and meeting the reporting schedules so that the Seychelles meets its obligations promptly.

A sustainable, climate-resilient and low-carbon Seychelles is the vision of the climate policy. The implementation of the mandates of the UNFCCC, as per Seychelles' vision, is a daunting task for a SIDS. The funding estimate from the NDC for the implementation of mitigation actions and projects across cross-cutting focus areas is USD 331.5 million for Mitigation actions and USD 388 million for Adaptation actions. For a small island developing state, Seychelles' economy is highly vulnerable to external shocks. The pandemic has created an economic downturn from which Seychelles is still slowly recovering. The transition to a low-carbon economy will need the support of international financial institutions, donors, and pledges made by Annex-1 countries to increase the availability of funds for Non-Annex-1 countries to implement their NDCs. The NDC presents the national areas that require funding for mitigation actions as part of the low-carbon transition.

Chapter 6 – Any other relevant information

According to Decision 2/CP.17, Annex 3, Para 2 (g), the scope of BURs includes providing an update on Any other information that the non-Annex I Party considers relevant to the achievement of the objective of the Convention and suitable for inclusion in its Biennial Update Report (BUR). Following this provision, this chapter captures an overview of a collection of additional initiatives over and above those reported in the preceding chapters that have been undertaken to address climate change in Seychelles. It also contains information and success stories from the transformational climate change policy and strategy initiatives on climate change, the drive for the renewable energy sector, the preparation of a National Adaptation Plan (NAP), the International Solar Alliance (ISA) collaborative platform, the Access Climate Finance through International Cooperation and Initiatives, the Stakeholder Engagement and Private Sector Participation in Climate Change Response.

Under the NDC Partnership's Climate Action Enhancement Package (CAEP) initiative, several vital organizations, e.g., the World Bank, the European Union, IRENA, UNDP, and GIZ, delivered targeted support for the enhancement and implementation of Seychelles' NDC through the provision of in-country technical expertise. Seychelles received support from the World Bank, the European Union, and UNDP to review its NDC, energy policy and energy legislation, the mitigation and adaptation components, enhance the quality, increase the ambition, and implement the NDC.

As a Small Island Developing State (SIDS), Seychelles has already embarked on the path to embrace renewable energy for its sustainable development. Formulating and adopting the new energy legislation is an important initiative to facilitate this process. The latest Energy Legislation (Energy Act) and policy framework have supported the adoption of renewable energy technologies and grid-connected rooftop photovoltaic systems in particular, designing and implementing financial mechanisms that will make the purchase and installation of solar PV systems more attractive to Independent Power Producers. So, the Energy Act has created a more dynamic market for stimulating energy efficiency and encouraged the import of more efficient appliances into Seychelles.

Seychelles Blue Economy Strategic Framework and the Blue Economy Roadmap, approved by the Government of Seychelles on 31st January 2018, is an integrated approach to ocean-based sustainable development that brings together the economy, the environment, and society, consistent with the Sustainable Development Agenda 2030 (SDGs), Aichi Target 11 of the Convention on Biological Diversity (CBD) and the Paris Agreement on Climate Change (2015). It articulates Seychelles' Blue Economy Brand as a unique comparative advantage based on sustainability credentials. It builds on Seychelles' national and international legal and policy frameworks and successful flagship initiatives such as marine spatial planning and innovative finance. It puts forward a prioritized agenda for action and investment to 2030.

At COP26, Seychelles, a large oceanic state with an Exclusive Economic Zone (EEZ) of 1.375 million square kilometers, urged the international community to recognize that the ocean and climate cannot be treated separately. There is a need for concrete ocean-climate action. Seychelles is ready to provide models and examples of what can be done. Most recently, Seychelles committed to pioneering new technologies to map seagrass ecosystems across its EEZ. Subject to external support. The country will further build upon its existing work to protect 30% of its EEZ by protecting at least 50% of its coastal wetlands by 2025 and 100% by 2030.

Such initiatives go beyond reaching climate goals to securing the same environment upon which Seychellois depend for their food, livelihood, and development. These nature-based solutions effectively secure livelihoods, build the economy's resilience, and contribute to food security. It must feature prominently in the African Union Green (and Blue) Recovery Plan and the Joint Action Plan. The COP27, the African COP, is the next climate milestone, and Parties must maintain the momentum on ocean and climate action. But it is not the only opportunity, as 2022 is also meant to be a Super Year for the Ocean during which the climate-biodiversity-ocean nexus can be addressed.

Seychelles has a predominantly service-based economy that relies heavily on climate-sensitive economic sectors such as tourism, agriculture, and fisheries. These sectors are particularly vulnerable to the current and future effects of climate change. Specifically, the increasing air and sea temperatures, rising sea levels, increasing rainfall variability, and the growing intensity and frequency of extreme weather events, including droughts, mudslides, and tropical cyclones, are negatively impacting tourism operations and reducing fishery yields, thus threatening the local population, the environment, and the economy. To adapt to these climatic effects, sustainable, climate-resilient planning is required in Seychelles, based on a firm scientific understanding of climate change and an adaptive approach to governance and climate financing.

CHAPTER 1 NATIONAL CIRCUMSTANCES AND INSTITUTIONAL ARRANGEMENT

1.1 Introduction

The Seychelles' Third National Communication (TNC) to the Conference of the Parties of the United Nations Framework Convention on Climate Change (UNFCCC) consists of six chapters. The activities within these chapters are a continuation and upgrade of the work done under the Initial (1997-2000) and the Second National Communication (2008-2011), including the technical needs assessment (2015). The main components of the TNC are a) an inventory of GHG emissions, b) an assessment of the potential impacts of climate change on the most vulnerable sectors, c) an analysis of the potential measures to decrease the increase of GHG emissions, d) National Action Plan to address climate change and its adverse impacts. The TNC further enhances the national capacities and raises the general awareness of the most significant threat of climate variability and change we Seychelles as small island developing states (SIDS) are facing. It also contributes to raising the concerns of higher priorities on the national agenda through strengthened cooperation and increased involvement of all relevant stakeholders. In addition, it builds national capacities for participation in different mechanisms related to GHG mitigation and fulfilling national capacities for participation in different mechanisms associated with GHG mitigation and fulfills other commitments to the UNFCCC.

In line with Paragraph 3 of the United Nations Framework Convention on Climate Change (UNFCCC), this chapter on the National Circumstances of Seychelles describes the national development priorities, objectives, and circumstances on the basis of which it will address climate change and its adverse impacts. It also provides information on features of Seychelles' geography, climate, and economy, which may affect Seychelles' ability and capacity to deal with mitigation and adaptation to climate change.

Thus, as a Non-Annex I Party, Seychelles is providing an assessment of appropriate information concerning its National Circumstances per the principle of common but differentiated responsibilities enshrined in the Convention. The convention further recognizes that each party is unique, so its climate change response strategy must be tailored to suit its particular circumstances.

1.2 Geographic Profile

Seychelles is an island archipelago in the Western Indian Ocean located between 3 and 10 degrees south of the equator and between longitude 46 and 57 degrees east (See Figure 1-1), and it is about 1,600 kilometers east of Kenya. It has a total land mass of 455 square kilometers and an Exclusive Economic Zone (EEZ) covering 1.374 million square kilometers. The land mass vis-à-vis the ocean space entails a paradigm shift in our thinking of Seychelles as a large ocean-developing state with oceans, seas, and marine resources that are central to the delivery of the 2030 Agenda for Sustainable Development, including the Sustainable Development Goals (SDG 14). The challenges of the blue economy are global. They will require global international solutions framed within national and regional priorities that support human well-being and livelihoods and underpin poverty eradication, food security, employment, industry, innovation, sustainable communities, health, tourism, and protection from natural disasters, and counteract the impacts of climate change as carbon reservoirs.

The archipelago consists of 115 islands, of which 42 are granitic, and the rest are of coralline origin. The main granitic islands, also known as inner islands, are Mahé, Praslin, Silhouette, and La Digue in descending order of size. The granitic group of islands is all within a 56- 56-kilometer radius of the main island of Mahe. These islands are rocky; most have a narrow coastal strip and a central range of hills rising as high as 905 meters. Mahe is the largest island, being 9,142 square kilometers, and it is the site of Victoria, the capital. The coral islands are flat, with elevated coral reefs at different stages of formation.

The main outer islands from north to south are Bird, Denis, the Amirantes group, Alphonse, Coetivy, and the Aldabra, Cosmoledo, and Farquhar groups. Figure 1-1 shows the physical location of the Seychelles archipelago, while Figure 1-2 shows the physical location of the granitic islands. Seychelles' vibrant but tranquil island society boasts one of the most pristine natural environments and beauty on the planet with warm crystal-clear waters and harbors flora and fauna so spectacular that almost 50% of land area has been set aside as natural reserves.

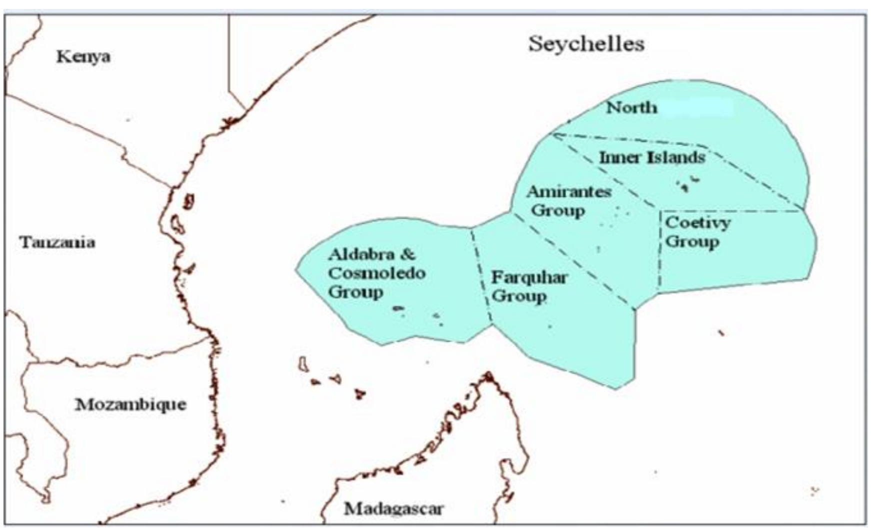


Figure 1-1: Physical location of the Seychelles Archipelago (Source: SFA, 2007)

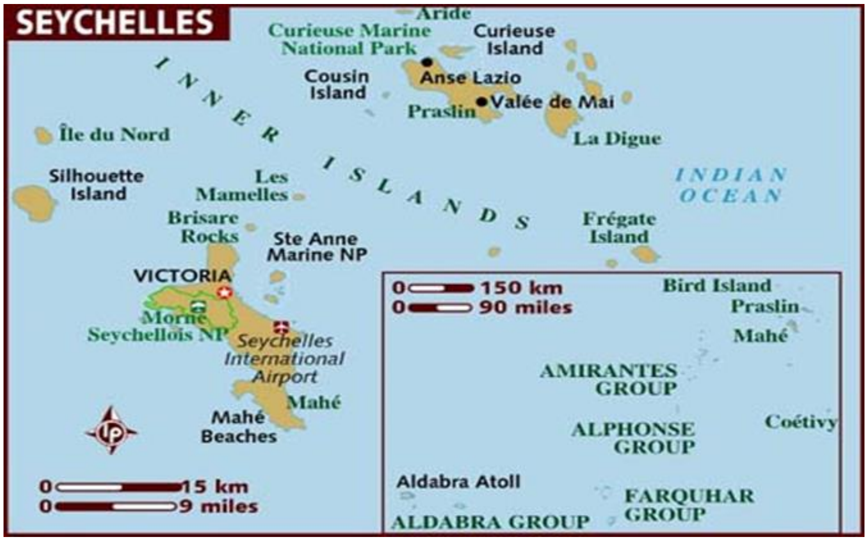


Figure 1-2: The Seychelles Archipelago showing the granitic Inner Islands

1.3 Climate Profile

1.3.1 General

The climate of the Seychelles' archipelago is strongly influenced by the ocean, especially primarily through changes in monsoonal winds, ocean currents, and sea surface temperature patterns, hence, a tropical maritime climate. In Seychelles, two distinct seasonal patterns associated with the wind regime dominate:;: the south-east monsoon, which blows from May to September and is associated with the dry season, and the north-west monsoon, from November to March, associated with the wet season, and also the Tropical Cyclone Season over the southwest Indian Ocean. Synoptically, the main central systems that govern weather over these parts of the world are the Inter-Tropical Convergence Zone. Hence, complex and highly interactive processes control the Seychelles' climate system. The interactions among these various processes are difficult to predict, not only because they may occur on widely differing temporal scales but also because of the relatively microscopic size and extensive spatial distribution of the islands in the Seychelles archipelago.

Detailed observational data in Seychelles have been available since the opening of the International Airport in July 1971, but rainfall data have been available for more than 100 years. Paleo-climatological evidence from sea-bed cores of the last 20,000 years indicates that there may have been drastic climatic variations within the Seychelles' region, drastic climatic variations in the Seychelles' region may have been mainly associated with changes in rainfall (Perlmutter et al., 1996).

1.3.2 Winds – South-East and North-West Monsoons

During a greater part of the year, trade winds blow from the south-east; they are steadier from May to September. The south-east trade winds keep the Seychelles cool during these months. Maximum wind speeds of between 100 to 120 km/hr are pretty common during the southeast monsoon, creating moderate to severe turbulence for aircraft on landing. Localized convective cloud formation passes by harmlessly, bringing only light to moderate rain and serving to clear the air after a spell of warm, dry weather. But the sea is usually moderate to rough.

From November to April, the winds are lighter. They are from the north-west, periodically interrupted by convective activities associated with the occasional storms and the season's Rain Belt known as the Inter Tropical Convergence Zone (ITCZ). The Rain Belt could be vigorous at times associated with the tail-end of a tropical cyclone, thus generating heavy downpours and rough sea conditions along the coast, albeit temporarily. Generally, the sea is calm around this time of the year except for moderate to severe storms during the active tropical cyclone season.

1.3.3 Rainfall

The topography of the Seychelles strongly influences rainfall patterns with orographic rains mainly on the leeward sides, which can brew severe thunderstorms. The rainfall varies according to the height above sea level, and mean conditions range from 73.9 mm in July to 408.2 mm in January. The mean annual rainfall total for Mahe is 2369.4 mm over the coastal areas. Still, it is expected to exceed most of Mahe's mean yearly rainfall total, which is 2369.4 mm over the coastal areas. Still, it is expected to exceed that amount over most hilly interiors. Rainfall also tends to be higher on the west-facing slopes and ridges of La Misere since most rainfall occurs during the north-west monsoon. The heavy downpour typically occurs mainly from late December to the beginning of January.

An analysis of rainfall for January, the month of maximum rainfall, indicates marked variability (influencing global oscillations such as the ENSO) throughout the 48 years. It reveals five significant peaks above 600mm in 1983, 1991, 2002, 2013, and 2019, respectively (see Figure 1-3), with 27 years of rainfall above the 408 mm average for that month. In contrast, July, the month of lowest rainfall (see Figure 1-4), depicts a decreasing trend, with 22 years of rainfall equal to or below 50 mm and 5 five years equal to or above 150 mm. The analysis clearly indicates that there is significant variability owing to not only the ENSO phenomenon but to several other factors influencing climate variability in the Seychelles. Figure 1-3, 1-4, and 1-5 shows the 48-year year Long Term Mean of monthly rainfall ([R/F(mm)] distribution over Mahe depicts the months of maximum and minimum rainfall, respectively.

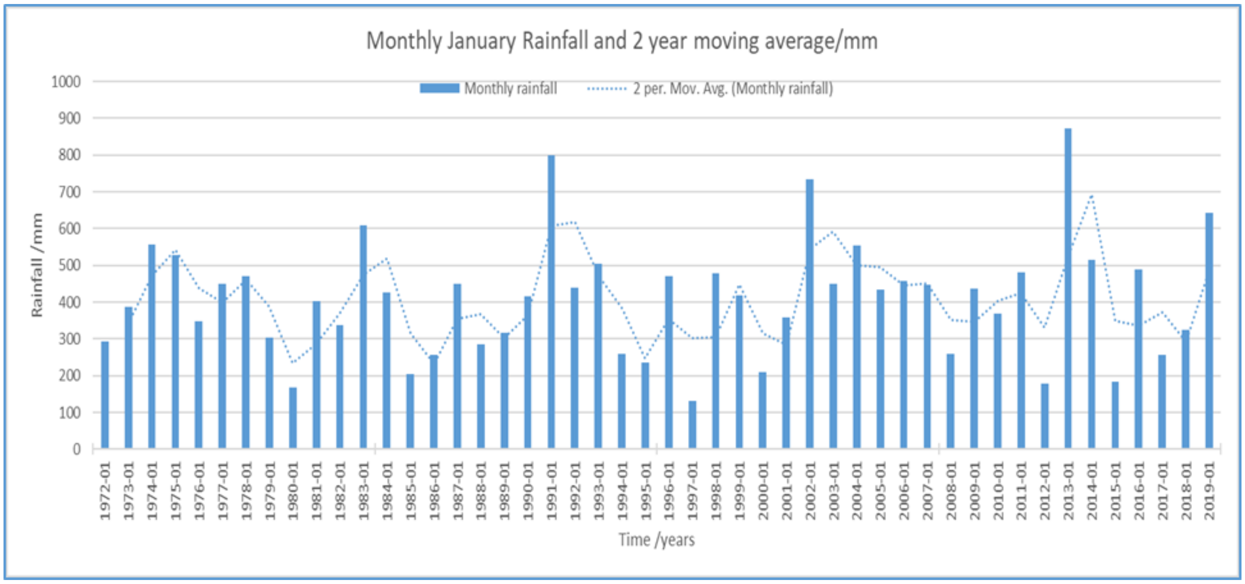


Figure 1-3: Annual Rainfall (R/F(mm) Distribution for January over Mahe (Source: SMA, 2020)

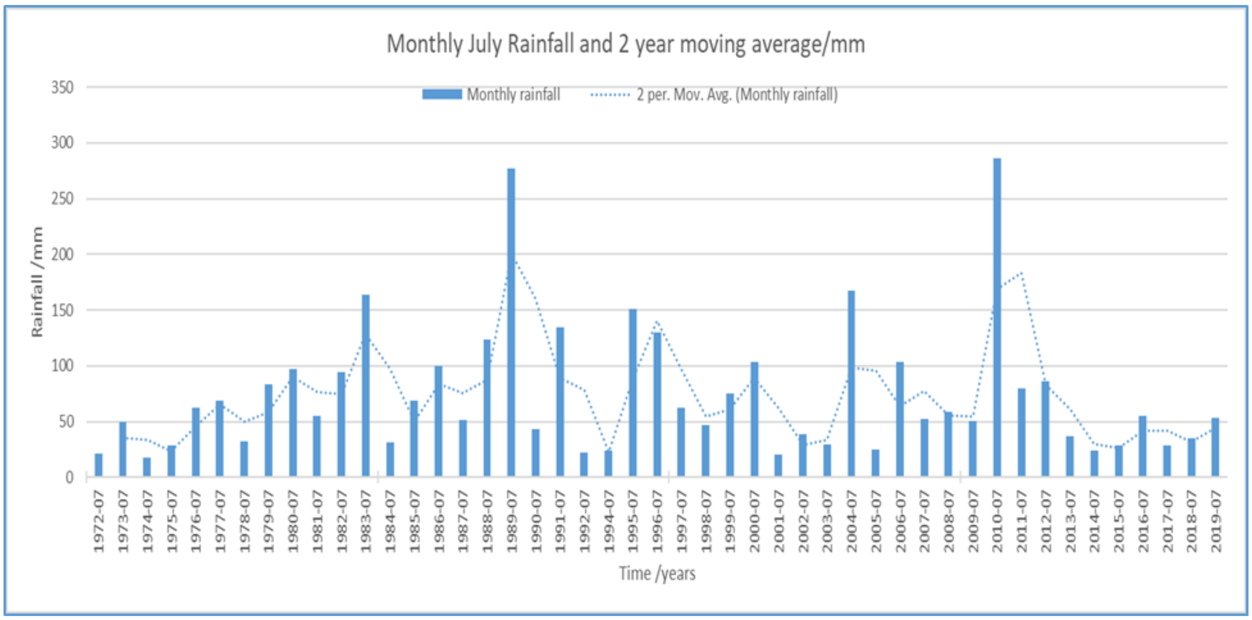


Figure 1-4: Annual Rainfall Distribution for July over Mahe (Source: SMA, 2020)

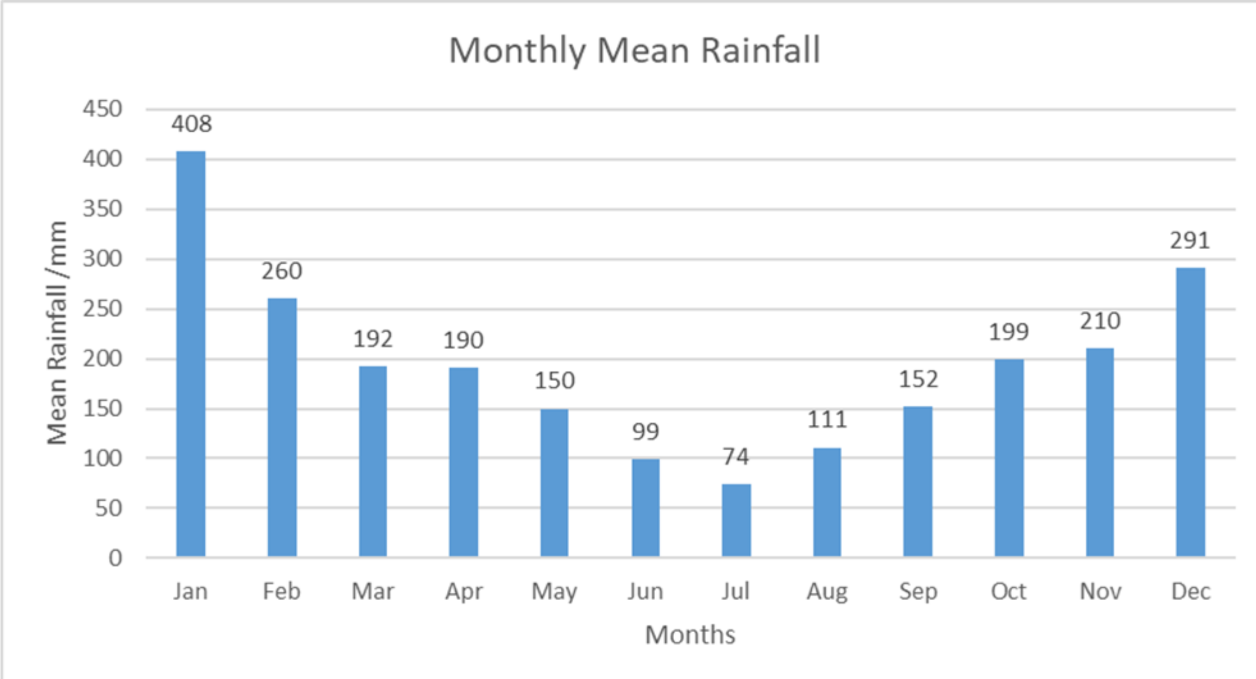


Figure 1-5: Forty-eight-Year Long Term Mean of Monthly Rainfall Distribution over Mahe (Source: SMA, 2020).

1.3.4 El Nino Southern Oscillation (ENSO) Events

The effects of the El Nino Southern Oscillation (ENSO) were also observed, in particular in 1997-1998, 2014-2016, when it caused significant damage to Seychelles' economy (Payet, 2005; and Cerrutti, 2018) and mass coral bleaching in Seychelles. It is not yet clear whether climate change will increase the occurrence of ENSO conditions in the long- term.

However, analysis of ENSO records from the 1950s to 2016 indicated a periodicity of 3 to 7 years, with greater, more significant intervals during the last four decades. In particular, there had been a rather distinct change from 1976 to 1977, with more frequent El Nino episodes, with a rather distinct change from 1976 to 1977, with more frequent El Nino episodes and only rare incursions of La Nina. It has been shown that for the majority of the El Nino cases, an extreme weather event occurred over the Seychelles. The extreme weather event occurred over the Seychelles for most El Nino cases. However, there have been other extreme weather events that have happened, apart from these El Nino episodes.

The Oceanic Niño Index (ONI) has become the de-facto standard that NOAA uses for identifying El Niño (warm) and La Niña (cool) events in the tropical Pacific. It is the running 3-month mean SST anomaly for the Niño 3.4 region (i.e., 5oN-5oS, 120o-170oW). Events are defined as 5 five consecutive overlapping 3-month periods at or above the +0.5 anomaly for warm (El Niño) events and at or below the -0.5 anomaly for cold (La Niña) events. The threshold is further broken down into Weak (with a 0.5 to 0.9 SST anomaly), Moderate (1.0 to 1.4), Strong (1.5 to 1.9), and Very Strong (≥ 2.0) events. For an event to be categorized as weak, moderate, strong, or very strong, it must have equaled or exceeded the threshold for at least 3 three consecutive overlapping 3-month periods (Table 1-1).

Table 1. 1: Tropical Pacific Nino Region ENSO Variation from 1950 to 2016 (Source: NOAA, 2017)

El Niño				La Niña		
Weak	**Mod**	**Strong**	**Very Strong**	**Weak**	**Mod**	**Strong**
1951-52	1963-64	1957-58	1982-83	1950-51	1955-56	1973-74
1952-53	1986-87	1965-66	1997-98	1954-55	1970-71	1975-76
1953-54	1987-88	1972-73	2015-16	1964-65	1998-99	1988-89
1958-59	1991-92			1967-68	1999-00	
1968-69	2002-03			1971-72	2007-08	
1969-70	2009-10			1974-75	2010-11	
1976-77				1983-84		
1977-78				1984-85		
1979-80				1995-96		
1994-95				2000-01		
2004-05				2011-12		
2006-07						

Figures 1-6 reveal that there are about five extreme events above average rainfall years (0 = >+1) for January and July. While there have been 7 seven extreme events below normal conditions for January and none for July (0 = <-1), Seychelles has experienced below average, with most above rainfall occurring after 1990 (Figure 1-7). It is worth noting that within the 1990s, Seychelles experienced a series of ENSO events. Still, the most remarkable ones were the El Nino of 1997-98, 2015-16, and the La Nina event of 1998-2001, which followed thereafter.

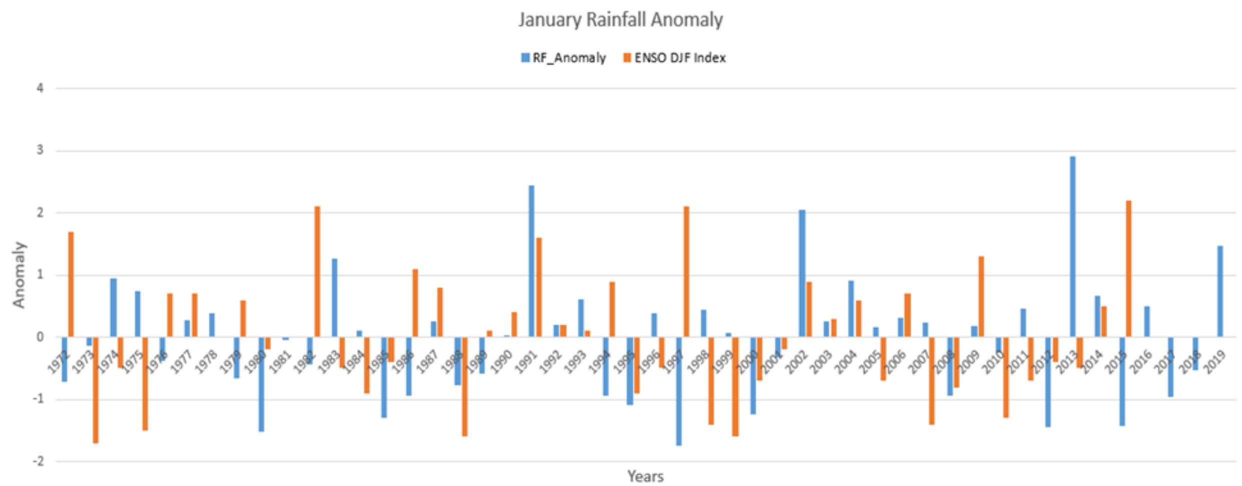


Figure 1-6: January rainfall Anomaly for the Seychelles' International Airport and DJF ENSO Index (Source: Marguerite, 2020).

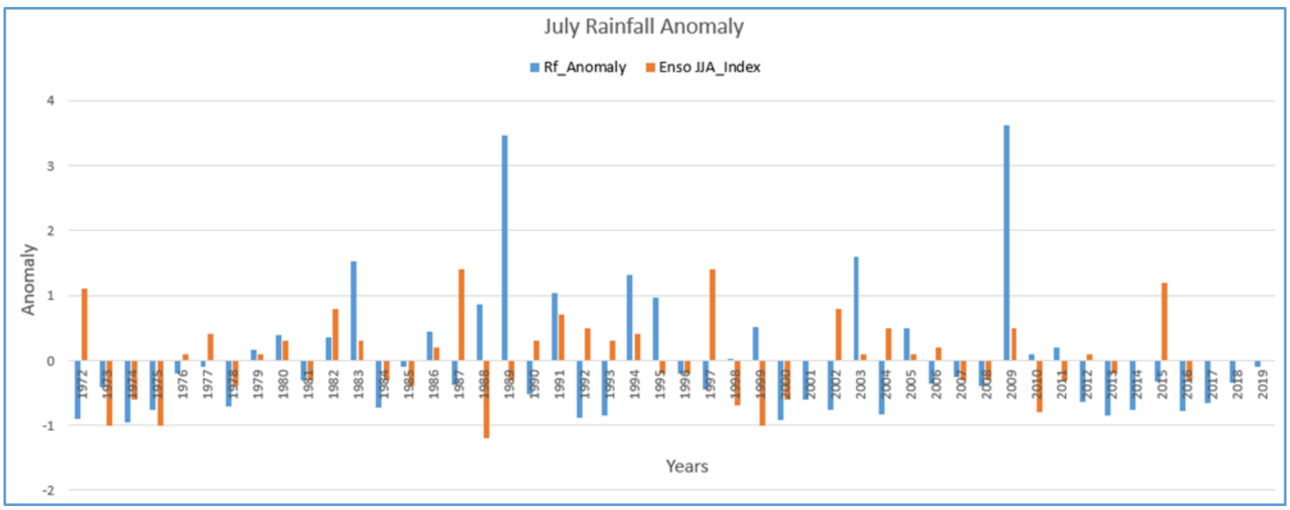


Figure 1-7: July rainfall Anomaly for the Seychelles' International Airport and DJF ENSO Index (Source: Marguerite, 2020).

1.3.5 Temperature

The temperature varies between 24°C and 26°C in July and August and between 27°C and 28°C in March and April. Near sea- level, the maximum temperature is about 4°C higher than at higher altitudes, reaching an average of 31°C at mid-day in April.

The warmer, wet season during the north-west monsoon months of November to March produces prolonged sunshine with extreme maximum temperatures of up to 34°C on the coasts, which short, heavy bursts of rainfall may break. From May to September, cooler and dry conditions are accompanied by extreme minimum temperatures of up to 19°C, with cooler nights and lower humidity, particularly at high altitudes. There is an average of seven hours of sunshine each day throughout the year. The maximum temperature is 30.00C; average minimum is 24.70C with average humidity at 80% (see Table 1-2).

Table 1. 2: Forty-eight Year Monthly Climatic Means and Extremes (Source: SMA, 2020)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
Max (°C)	30.0	30.5	31.2	31.6	30.8	29.3	28.6	28.7	29.3	29.9	30.3	30.3	30.0
Min (°C)	24.4	25.0	25.2	25.4	25.7	24.9	24.2	24.2	24.5	24.7	24.4	24.3	24.7
Highest Max (°C)	33.3	33.4	33.7	34.8	33.5	32.7	31.3	31.4	31.6	32.4	33.5	33.4	
Year	2003	1988	2013	2013	2005	2019	2019	1992	2008	1990	1973	1997	
Lowest Min (°C)	21.4	21.1	22.1	22.0	21.6	20.9	20.4	19.6	20.2	20.5	21.5	20.0	
Year	1993	1976	1979	2012	1984	1991	1984	1977	1974	1978	1995	1973	
Rainfall (mm)	409.7	259.7	192.1	190.4	149.8	98.7	74.0	110.9	151.9	199.2	209.9	291.2	2337.5
Highest Rainfall	871.7	611.0	465.8	463.2	558.9	528.6	287.6	694.1	456.8	780.1	441.2	606.9	
Year	2013	2001	2000	1992	1992	1997	2009	1997	2002	2011	1981	2005	
Lowest Rainfall	132.0	9.1	54.7	61.8	6.7	15.1	17.6	15.0	13.0	8.8	31.4	57.9	
Year	1997	1982	2009	1981	1974	2011	1974	1990	1986	2001	2010	1987	
Humidity (%)	82	80	79	79	79	79	80	79	79	79	80	81	80

1.4 Population Profile

During the 15th and 16th centuries, the Seychelles' islands were sporadically inhabited by pirates. Still, it was not until the middle of the 18th century that the first twenty-eight settlers were brought in to live on the island of St. Anne, where they established themselves in 1770. The population originated primarily from French settlers, African plantation workers, British sailors, and traders from the Asian continent, primarily from India, China, and the Middle East. The population has subsequently grown, and when the latest census was conducted in 2010, there were 88,311 inhabitants (compared to 81,200 in 2002). When the latest census was conducted in 2010, there were 88,311 inhabitants (compared to 81,200 in 2002). In 2019, the population estimate of Seychelles stood at 98,055 (NSB, 2020) (see Table 1-3) and was projected to reach 104,000 by 2030 (NSB, 2019). With a literacy rate of 97% and a high average life expectancy of 74 years, the Seychelles enjoy a high quality of life despite the challenges of being a small island developing state. The labor force stands at 51,152 (57.7%), of whom 94.2% are in employment while 5.8% are unemployed.

The bulk of the population, economic activities, and other forms of development are concentrated chiefly on the narrow coastal strips of the three main granitic islands of Mahe, Praslin, and La Digue. Mahe, in particular, has about 87% of the total population (Table 1-3), with some 40% located on the east coast in a belt of 7 km by 1 km to the south of the capital, Victoria. The population is projected to reach 100,000 by the year 2022.

Table 1. 3: Main Characteristics of the Population of Seychelles as at of 31st December 2018

Population	(Year)2014	2015	2016	2017	2018
Total Resident Population ('000)[1]	91.4	93.4	94.6	95.8	95.8
Male	45.3	46.3	47.3	48.8	49.3
Female	46.1	47.1	47.3	47.0	47.5
Geographical Distribution ('000)					
Mahe	78.9	80.7	81.8	82.8	85.3
Praslin	8.7	8.9	8.9	9.0	8.6
La Digue and Outer Islands	3.8	3.8	3.9	4.0	2.9
Age Composition (%)					
Under 15 years	19.9	20.2	20.1	19.2	19.9
15-44	41.9	41.8	40.3	37.9	37.3
45—64	22.2	23.6	26.1	29.5	29.9
65 years and over	7.4	7.8	8.3	9.2	9.7
Life Expectancy at Birth (years)					
Both Sexes	73.2	74.2	74.8	74.3	72.6
Male	68.4	70.1	69.5	70.3	68.5
Female	78.3	78.7	80.8	78.5	77.3
Infant mortality Rate	10.9	10.7	13.4	10.9	18.8
Crude birth rate Per 1,000 population	17.0	17.1	17.4	17.2	17.1
Crude death rate	7.9	7.5	7.9	7.8	8.4
Projected Population ('000) [1]	**2030**	**2035**	**2040**	**2045**	**2050**

[1] Based on 2010 Census results, Population Projections report 2014-2080.

Male	52.9	53.3	53.4	53.3	52.9
Female	51.9	53.0	54.1	54.7	54.8
Total	**104.8**	**106.3**	**107.5**	**108.0**	**107.7**

Source: National Bureau of Statistics (2019) Seychelles in figures; Population and Vital Statistics, 2019

To date, almost all of the coastal plains are heavily built or developed, and reclamation of mangrove areas for additional land is a practice, albeit not as common as before. Due to increased pressure for land for development and in line with its policy for forest conservation, Seychelles embarked on a series of land reclamation projects on the east coast of Mahe and Praslin Island. These coastal reclamation projects already accommodate large numbers of residential areas, industrial areas, and other critical infrastructure such as the central power station, telecommunication hub, and other vital services.

The population density in Seychelles is 163 persons per square kilometer. On Mahé, the density is very high, estimated to be about 434 persons per square kilometer. The most densely populated are those districts located on the outskirts of Victoria, with a density of about 3000 persons per square kilometer, as compared to about 100 in the more rural areas of the island. The urbanization urbanization rate is estimated at 2.2 % per year. It was identified that there were three main forces driving internal migration over the last two decades: employment, education, and housing. Consideration of international migration statistics shows an increase in migrants to the Seychelles.

1.5 Energy Profile

The issue of energy is critical for Seychelles and for its future a. As the population growth and development continues, so does its energy needs. The amount of petroleum products Seychelles is consuming now is not sustainable in the long term. The energy policy of 2010 and the energy commission have led to the introduction of renewables since 2013 (wind and solar) into the mix with 2.55% as of 2018. Using energy more efficiently makes a great deal of sense to many industries and the country in general, both economically and environmentally. The contribution of alternative/renewable energy sources is quite relatively low. Still, with the new solar farm at Romainville island and the first floating solar PV farm in Africa at the Providence industrial lagoon, Seychellles is expected to reach its Nationally Determined Contribution (NDC) 2020 target of 5% by 2025. The most common renewable energy source is the solar panel for water heating for bathing. Some biomass (wood) is used to produce heat for drying food products.

1.5.1 Energy Demand

Seychelles depends upon imported petroleum products for its energy needs. Use The use of renewable energy forms is increasing, with wind and solar as the most promising alternatives. Solar water heaters for hot water have been on the rise, with eight solar energy companies registered with the energy commission. As of 2018, rooftop PV is at 3534813 kWh (kilowatt hour) for Seychelles, with Mahe at 2,919,796 kWh and Praslin/La Digue @at 615,017 kWh (Figure 1-7 and 1-8). There was a consumption of 34.9 kTOE (Kilo Tonne of Oil Equivalent) of fuel in 2016 (PUC, 2018), an increase of up to 25.8% above the 2010 consumption levels. In 2016, Seychelles' primary energy consumption reached 180,000 TOE (see Figure 1-8). This rapid growth is attributed to recent economic expansion, in particular, particularly in the tourism sector in the last 5five years and the doubling of the national GDP.

The transport sector consumed 48% of energy in 2010 (Figure 1-9), and the fuel imports were 22% of the GDP in the same year. Seychelles' energy demand and imports rose from 2010 to approximately 450GWh in 2019 (Figure 1-10), with a peak demand of 59MW of electricity per day. However, Seychelles only consumes one-third of what is imported; the remainder is exported as an international bunker.

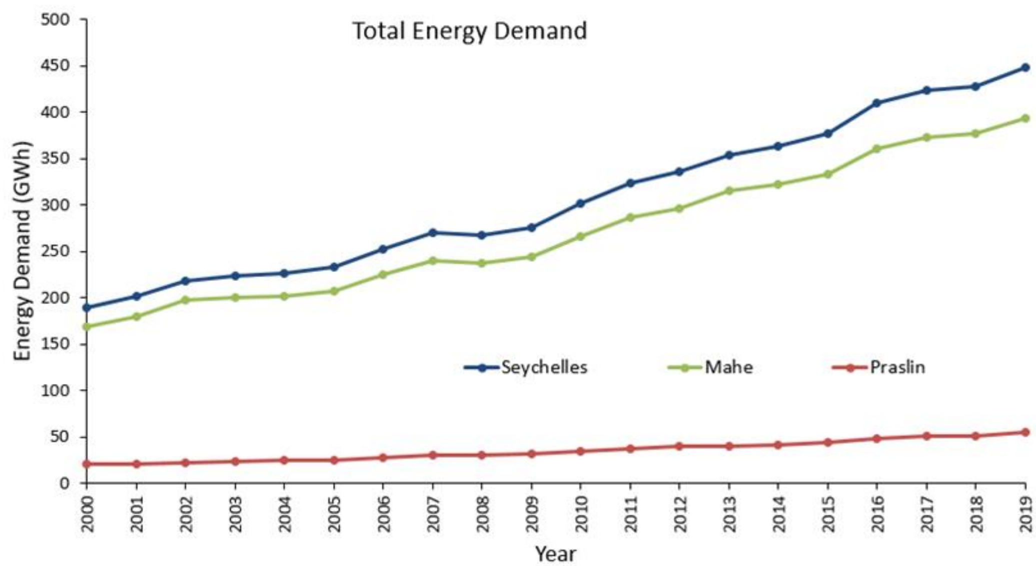


Figure 1-8: Trends in Primary Energy Consumption (PUC, 2016)

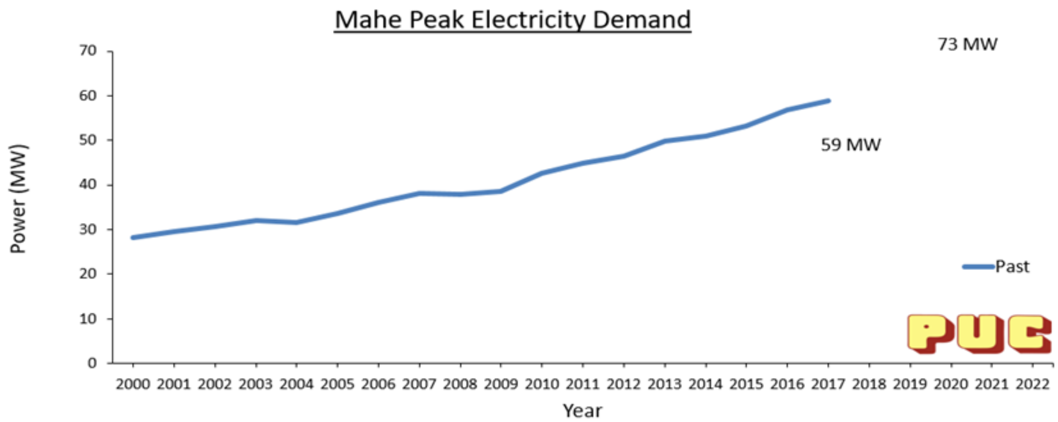


Figure 1-9: Trends in Primary Energy Consumption (PUC, 2016)

Seychelles is an archipelago and depends upon air and sea transport to connect it to the rest of the world. Since the tourism and fisheries industries are heavily dependent upon those forms of transportation, historical changes in airlines and shipping have affected the economy of Seychelles. Notable examples include the Gulf War, which affected airline travel to the Seychelles, and the recent attacks of piracy in the northern Indian Ocean that caused an increase in shipping and insurance costs.

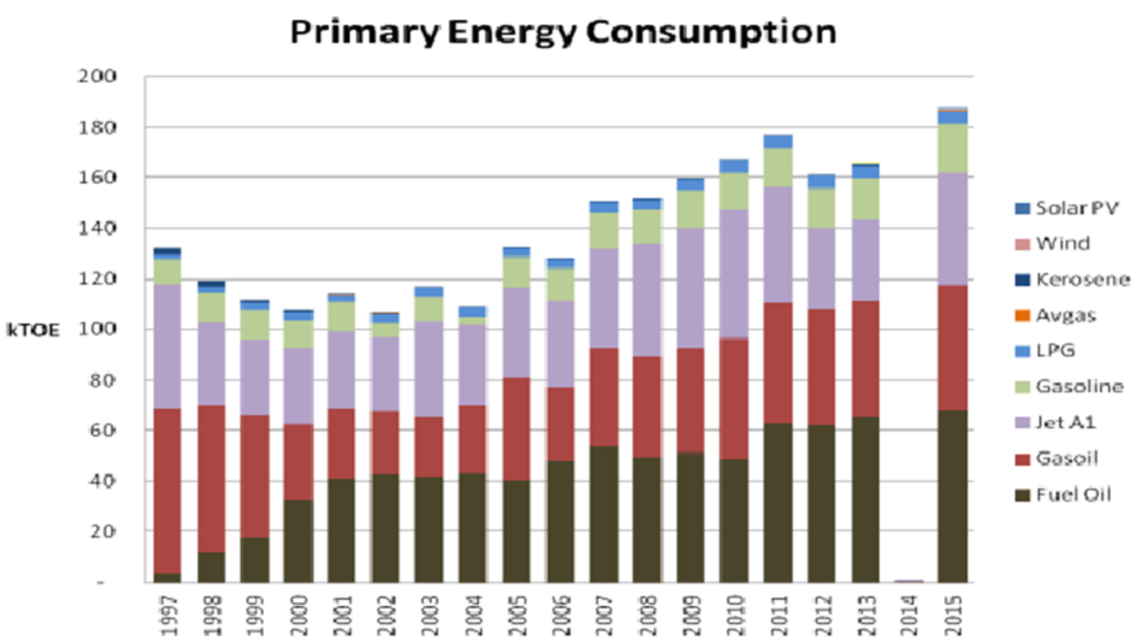


Figure 1-10: Trends in Primary Energy Consumption (GoS, 2016)

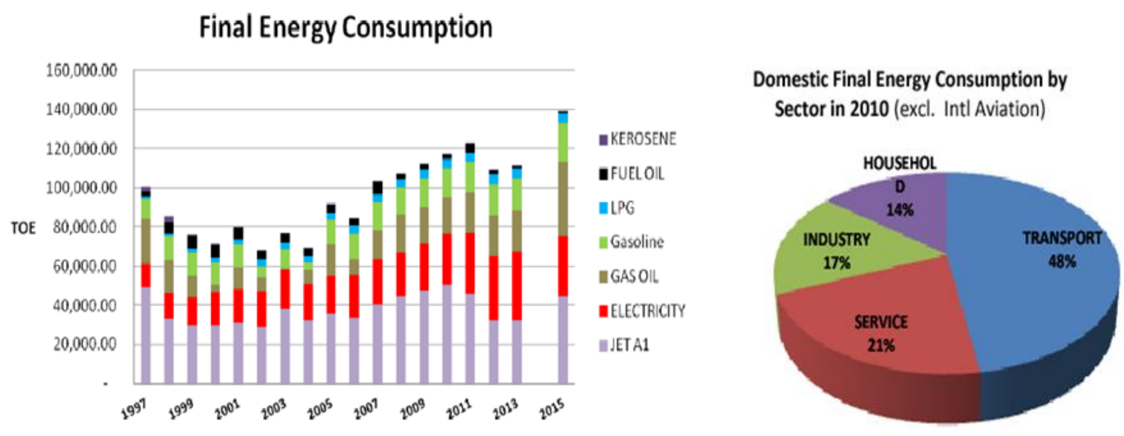


Figure 1-11: Final Energy Consumption 1997- to 2015

Virtually no mitigation projects have been implemented in Seychelles since it ratified the UNFCCC. In January 2009, an MOU was signed between Seychelles and MASDAR (a renewable zero-carbon initiative by the United Arab Emirates; www.masdar.ae) for the establishment of an 18 MW wind energy farm on Mahe, the most densely inhabited island. Detailed feasibility studies for the wind turbines are ongoing, and other options, such as solar photovoltaic farms, are being explored.

1.6 Agricultural Sector

1.6.1 General overview

Agriculture was the main economic activity in Seychelles up to the early 1970s. However, the national country's development agenda turned to reliance on tourism and fisheries as the main pillars after the development building of the international airport. The agricultural sector remains vulnerable to climate change and climate variability and suffers many challenges, such as a high prevalence of crop pests and diseases, bushfires, soil erosion, soil fertility loss, insufficient financial investments, fertility loss, etc.

In 2018, the Seychelles' Gross Domestic Product (GDP) was estimated at USD 1,317 million, of which agriculture accounted for approximately 2.2 percent. With the recent global food crisis, the issue of national food security has taken the highest priority in Seychelles.

Agriculture in Seychelles is characterized by a relatively large number of small farms with an average size of 0.5 hectares and rarely exceeding 2 hectares, employing various levels of technology and management.

1.6.2 Crop Production

Seychelles has limited agricultural land for reasons such as the small size of the islands, its granitic surface, and the fact that 50% of Mahe, Praslin, and La Digue are protected forests. Developments mainly in the tourism sector, coupled with accelerated urbanization, have resulted in essential losses of agricultural land over the past three decades. Most arable lands are in remote mountainous areas, limiting market and water supply access. Owing to its vulnerability as a SIDS, where variations in climate patterns (mainly rainfall and temperature) result in essential changes in cropping systems affecting productivity and production, food security remains a concern. It is estimated that about 6,000 hectares (ha) are designated as agricultural land available for agricultural development, of which only 600 ha are utilized, with 300 hectares under intensive cultivation. Some 416 farmers were registered for farming in 2007, of which 310 were located on the main island of Mahe, 96 were on Praslin, and 10 were on La Digue. In addition, the agricultural census conducted in 2010 - 2012 revealed that 8500 families in Seychelles were engaged in home gardening, also known as backyard farming. To the registered farms, a relatively high number are subsistence farmers, farming mainly for home consumption and/or to supplement income. (The number of registered farms can vary from year to year, and during the February 2009 meeting with personnel of the Seychelles Agricultural Agency, there were 580 registered farms).

The 2010-2012 census of Seychelles' agricultural sector (CoA12 10.) shows that the country has a narrow agricultural production base (only 530 market-oriented farms, 1,330 artisanal fishers, and roughly 8,500 households classified as backyard farmers out of a total of 25,000 households). About 28% of farms were below 1 acre in size, 31% were between 1 and 2 acres, 33% were between 2 and 5 acres, and only 9% were above 5 acres.

The Seychelles National Agricultural Investment Plan (SNAIP, 2015), developed in line with the context of the broader national development priorities and goals, provides a framework to foster coherence and alignment across the various sub-sectors and institutions. The SNAIP provides a national agenda on agriculture and national programs to produce enough food locally and thereby enhance Seychelles's ability to provide the food and nutrition needs of its people, even in times when local and/or external factors may limit or hinder access to global food sources. Finally, the government and all stakeholders have to work in a harmonized and consultative manner. The Government of Seychelles is appealing to all public and private sector actors in the agricultural sector for their support and commitment to implementing the SNAIP for the country to achieve its vision.

The total area equipped with irrigation is estimated to be some 260 ha, of which approximately 20 ha are surface irrigated, 40 ha sprinkler irrigated, and 200 ha drip irrigated. Surface water is used for irrigation; all irrigation schemes are medium-scale, and all irrigation schemes are medium-scale (2−70 ha) and state-owned. The main irrigated crops are cabbage and Chinese cabbage, pumpkin, beans, tomatoes, eggplant, cucumber, lettuce, spring onion, cocoyam, capsicum, okra, spices, herbs, and flowers.

Crops such as sweet potatoes, cassava, plantains, sugar cane, bananas, and citrus fruits are rain -fed but irrigated at the planting stage.

The cultivation and exploitation of traditional crops like cinnamon and coconuts, along with patchouli and vanilla, have dropped considerably during the last two decades and contribute insignificantly to the sector as of today.

Extreme weather and rainfall have caused significant agricultural crop losses in the last decades, with cyclones Felleng and Fantalla causing havoc on Farquhar and the associated cloud system affecting the main islands. Lost and damages amounted to millions of Seychelles' rupees, and the Government of Seychelles sought international assistance from development partners. The extreme temperature over the 2015-16 during the El Nino and the La Nina events have profoundly impacted the Seychelles' economy. Fisheries suffered the most tremendous loss in monetary terms, accounting for 45% of the total losses. This trend in losses was followed by agriculture (28%), tourism (12%), industry (7%), construction (5%) and forestry (3%). The supporting services to these sectors were also affected.

1.6.3 Livestock Production

Livestock farming in the Seychelles consists predominantly of commercial pig and poultry farming. Because of the limited land availability, cattle is farmed to a very minimal extent, with fewer farmers engaging in livestock rearing only (see Table 1-4).

Of the total of 416 registered farms, 148 farms are engaged in sole livestock farming and/or mixed crop and livestock farming activities, out of which some 108 are registered for pig production (fattening & breeding). Registered pig farms represent farms with an annual production of 25 heads or more. Most registered pig farms (99 out of 108) are based in Mahe, while 7 seven pig farms are in Praslin, and 2 two are in La Digue.

Table 1. 4: Number and Type of Livestock Farms in the Seychelles

Name of Island	Number of Livestock Farm	Type of Livestock Farm	Number of Livestock
Mahe	134	99 Pig Fattening & Breeding 23 Poultry – Layer 12Poultry – Broiler	7844 92000 16000
		7 Pig Fattening & Breeding	490

Praslin	11	4 Poultry – Layer 1 Poultry – Broiler	7200 16000
La Digue	3	2 Pig fattening & Breeding 3 Poultry – Layer	6800 560

Source: Livestock Section, Seychelles Agricultural Agency (SAA), 2008

Table 1. 5: Agricultural production in the Seychelles

Agricultural production Cash crops (tonnes)	(Year)2014	2015	2016	2017	2018
Copra	2	10	-	-	-
Cinnamon bark	8	7	3	4	5
Tea (green leaf)	27	17	17	12	3
Livestock slaughters (nos.)					
Cattle	68	65	48	52	45
Pigs	5,761	5,753	5,965	5,514	5,414
Chickens	221,821	349,521	315,588	417,001	398,020
Eggs (millions)	26	30	37	23	32

With the assistance of the Ministry of Agriculture and Fisheries and the authors, namely Samuel Tetteh Partey (ICRISAT/CCAFS), Prosper Houessionon (ICRISAT/CCAFS), along with, and Theodore Marguerite (International Consultant, 2019), a product of the collaborative effort between the International Center for Tropical Agriculture (CIAT) lead Ccenterer of the CGIAR Research Programme on Climate Change, Agriculture and Food Security (CCAFS), Tthe International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and Tthe Food and Agriculture Organization of the United Nations (FAO) towards the identification of country-specific baselines on CSA in the Africa's Small Island Developing States (of Cape Verde, Guinea-Bissau, and Seychelles). The publication is based on data collected by FAO in collaboration with CSA stakeholders and partners in Seychelles and on previous work commissioned and led by the World Bank Group to identify country-specific baselines and entry points for scaling out CSA through data analysis and a series of dialogues with national stakeholders.

The Seychelles' climate climate-smart agriculture (CSA) profile reflects an ambition to improve the integration of agricultural development and climate responsiveness. It aims to achieve food security and broader development goals under a changing climate and increasing food demand. CSA initiatives sustainably increase productivity, enhance resilience, and reduce/remove greenhouse gases (GHGs), and require planning to address trade-offs and synergies between these three pillars: productivity, adaptation, and mitigation. The priorities of the countries and stakeholders aim at achieving more efficient, effective, and equitable food systems that address challenges in environmental, social, and economic dimensions. At the same time, the concept of CSA is new and still evolving. Many practices that make up CSA already exist worldwide and are used by farmers to cope with various production risks. Mainstreaming CSA requires critical stocktaking of ongoing and promising practices for the future and of institutional and financial enablers for CSA adoption.

The Seychelles' profile provides a snapshot of a developing baseline created to initiate discussion, both within the country and globally, about entry points for investing in CSA at scale. It was to highlight the gaps, knowledge, challenges, and priority areas that will help assist in the mitigation and the adaptation efforts of ouSeychelles'r vulnerabilities, at both the policy and institutional level, with the implementation of an ongoing COMESA CSA project at Val d'eEndore on the west coast of Mahe island.

1.7 Government Profile

Table 1. 6: An overview of Seychelles' administrative profile

Government type	Presidential Republic
Administrative Divisions	26 Administrative districts; Anse aux Pins, Anse Boileau, Anse Etoile, Anse Royale, Au Cap, Baie Lazare, Baie Sainte Anne, Beau Vallon, Bel Air, Bel Ombre, Cascade, Glacis, Grand Anse, Mahe, Grand Anse, Praslin, Inner Islands, La Riviere Anglaise, Les Mamalles, Mont Buxton, Mont Fleuri, Perseverance, Plaisance, Pointe Larue, Port Glaud, Roche Caiman, Saint Louis, Takamaka
Independence	29 June 1976 from the UK
Main National Holiday	Constitution Day, 18 June (1993); Independence Day (National Day), 29 June (1976)
Constitution	• **History:** Previous 1970, 1979; latest drafted May 1993, approved by referendum 18 June 1993, effective 23 June 1993 • **Amendments:** proposed by the National Assembly; passage requires at least a two-thirds majority vote by the National Assembly; passage of amendments affecting the country's sovereignty, symbols and languages, the supremacy of the constitution, fundamental rights and freedoms, amendment procedures, and dissolution of the Assembly also requires approval by at least 60% of voters in a referendum; amended several times, last in 2017
Legal System	Mixed legal system of English common law, French civil law, and customary law
Suffrage Universal	18 years of age.

Gender Participation in Political Process	• Women participate actively in the government of the country and have held numerous posts; • Including holding key positions in the Cabinet and have seats in the National Assembly.
Culture	• Seychellois culture has been shaped by a combination of European, African and Asian influences. • The main European influence is French, recognizable in Seselwa, the Creole language that is the lingua franca of the islands, and in Seychellois food and religion, the French introduced Roman Catholicism, the religion of most islanders. African influence is revealed in local music and dance as well as in Seselwa. • Asian elements are evident in the islands' cuisine but are particularly dominant in business and trade.
Executive Branch	• **Head of State and Head of government**: The President is both Head of State and Head of government • **Elections/appointments:** President directly elected by absolute majority popular vote in 2 rounds if needed for up to two consecutive 5-year terms; • **Cabinet**: Council of Ministers appointed by the President; • The United Seychelles party, formerly known as Parti Lepep, governed Seychelles following the 1977 coup and won every election from the introduction of multi-party democracy in 1993 until 2016 when a coalition of opposition parties won the majority of the National Assembly seats • Shortly afterward, President James Michel resigned in favour of his Vice President, Danny Faure; • ₽ Danny Faure became President on 16 October 2016; • The current era of divided government, with one party in the Presidency and another in control of the legislature, has so far resulted in political stability; • The next Presidential election was held in October 2020.
Legislative branch	• **Description:** The National Assembly has a maximum 35 seats, elected by universal adult suffrage—25 seats are decided by simple majority and a maximum of ten seats by proportional representation (one seat for each 10% of the vote that a party wins); current assembly has 33 seats; • **Last Election results**: Percentage of vote by party - LDS 49.6%, PL 49.2%, other 1.2%; seats by party - LDS 19, PL 14; composition - men 26, women 7, percent of women 21.2%; • The next National Assembly election was held in October 2020.
Judicial branch	• **Highest courts:** Seychelles' Court of Appeal (consists of the court president and 4 justices); Supreme Court of Seychelles (consists of the chief justice and 9 puisne judges); Constitutional Court (consists of 3 Supreme Court judges) • **Judge selection and term of office:** All judges appointed by the President of the Republic upon the recommendation of the Constitutional Appointments Authority, a 3-member body, with 1 member appointed by the President of the Republic, 1 by the opposition leader in the National Assembly, and 1 by the other 2 appointees; judges serve until retirement at age 70; • **Subordinate courts**: Magistrates' Courts of Seychelles; Family Tribunal for issues such as domestic violence, child custody, and maintenance; Employment Tribunal for labor-related disputes

International organization participation	• **ACP, AfDB, AOSIS, AU, C, CD, COMESA, EITI (candidate country), FAO, G-77, GCF, GEF,IAEA, IBRD, ICAO, ICC (NGOs), ICCt, ICRM, IDA, IFAD, IFC, IFRCS, ILO, IMF, IMO, InOC, Interpol, IOC, IOM, IPU, ISO (correspondent), ITU, MIGA, NAM, OIF, OPCW, SADC, UN, UNCTAD, UNEP,UNESCO, UNCCD,UNFCCC, UNIDO, UNWTO, UPU, WCO, WHO, WIPO, WMO, WTO (observer)**
National symbol(s)	• Coco de mer; national colors: blue, yellow, red, white, green

1.8 Economy Profile

1.8.1 Introduction

As a small open economy dependent on tourism, Seychelles remains vulnerable to global developments such as economic downturns in countries that supply tourists, natural disasters, and changes in local climatic conditions and ocean temperature. One of the main challenges facing the government is implementing strategies that will increase Seychelles' long-term resilience to climate change without weakening economic growth.

Tourism, industrial tuna fisheries, and offshore financial activities are central growth stimulants. However, the economy's high dependence on tourism for foreign exchange earnings leaves the external account vulnerable to developments in major tourist markets, such as the European Union and, increasingly, China. The country's limited availability of land lack of land as well as its physical remoteness, will continue to constrain Seychelles' growth prospects. New offshore hydrocarbon discoveries and installing floating solar panels will likely reduce Seychelles' dependence on energy imports and boost its economic diversification. The government has offered exploration tenders for offshore deep-water blocks along the Seychelles-Mascarene Ridge Basin, containing an estimated 797 million barrels of oil. It has signed production agreements with two oil companies, PetroQuest International and East African Exploration. Exploration will likely be tightly regulated in keeping with Seychelles' 'blue economy' water resources sustainability.

1.8.2 Economic developments and outlook

However, the economy declined during 2001–04 before growth strengthened between seven to ten percent in 2005–07 due to increased foreign direct investment and tourism receipts. Then, following the economic crisis and resulting sovereign debt default in 2008, in the teeth of the world economic downturn, the economy stalled with a sharp fall in tourism income and cuts in public expenditure. GDP shrank by 2.1 percent in 2008 and 1.1 percent in 2009, and Seychelles turned to the IMF for emergency support.

Through a prudent economic reform program initiated in late November 2008, Seychelles made significant progress in achieving economic stability and fiscal sustainability. In 2010–11, the economy bounced back, with two years of strong growth, followed by good steady growth in 2012–15. Growth has been led by the tourism sector, which directly employs about 26% of the labor force and indirectly accounts for more than 55% of GDP, along with tuna fishing. The Seychelles Government has recently encouraged foreign investment to upgrade hotels and tourism industry services. At the same time, the government has moved to reduce the dependence on tourism by promoting the development of the offshore financial, information, and communication sectors and renewable energy. As a result, the economy grew by an average rate of 4.2% annually between 2009 and 2019. With the help of an International Monetary Fund program, the government maintained its target of a 2.5% primary balance. It was on target to reduce the debt-to-to-GDP ratio to 50% by 2021. Prudent monetary policy also led to a build-up of the gross international reserves to 3.5 months of sustained import coverage by 2019 from less than one month at the end of 2008.

Since Seychelles' graduation to the high-income economy status in 2015., the country has been faring well compared to most small island developing states. In June 2019, Fitch Ratings, a credit rating agency, upgraded Seychelles' sovereign credit rating to 'BB'. This provides a promising outlook for Seychelles as it informs existing and potential investors about the country's creditworthiness.

1.8.3 Impact of the COVID-19 on the Economy

The economic and social shock from the COVID-19 pandemic (coronavirus) on the Seychellois' economy was severe due to strong dependence on international tourism. Tourism accounts for approximately 30% of the gross domestic product (GDP), making the Seychelles vulnerable to the COVID-19 pandemic. The global outbreak drastically reduced economic activity, and in 2020, tourist arrivals were projected to decline by more than 50%. This affected other sectors such as transportation, art, recreation, entertainment, wholesale and retail trade, and financial and insurance. GDP was expected to contract by 15.9% in 2020 compared to the pre-pandemic projected growth rate of 3.5%. Recovery was expected to begin in 2021, with a projected increase of 4.7% driven by a recovery in the tourist industry and a resumption in capital flows. If unmitigated, the people experiencing poverty are expected to bear a disproportionate impact of the economic shock. According to the 2013 household survey, about 6 out of 10 poor individuals have a job, primarily in informal activities in the service sector, that were expected to experience significant declines.

1.9 Tourism sector

The economy of Seychelles is primarily services-oriented. Tourism contributes significantly to the country's economy by generating foreign exchange earnings and government revenue, stimulating economic growth, and creating jobs. In 2018, tourist arrivals rose by 3 percent from 2017, directly contributing 23.2 percent of the total GDP. In 2019, tourist arrivals grew by 6 percent, contributing to a forecast of 24 percent of the total GDP. Seychelles has established a strong tourism brand that elevates the country's position in the global tourism market.

1.9.1 Impact of COVID-19 on Tourism

The impact of the COVID-19 pandemic on the performance of the tourism sector in Seychelles has been enormous, and there has been a plan for a swift recovery process. Seychelles strives to ensure that adequate measures are in place and that the safety of the Seychellois people and visitors is maintained. As a safe tourism destinationAs a safe tourism destination, the Seychelles has produced guidelines and protocols that help aid in its national efforts to recommence tourism activities. In this new post-COVID-19 tourism landscape, the global tourism industry will likely head towards quality-oriented tourism, particularly wellness and nature-based activities. The tourism industry's operators need to show strong, creative, and resilient skills to put into place innovative solutions operators need to show robust, creative and resilient skills to put innovative solutions into place to rebuild a sustainable tourism industry. Entrepreneurial ideas for products and sales and, in general, for new business models based on customer demand and behavior will be key to helping the sector mitigate the impact of the pandemic and kick-start effective practical recovery efforts.

Seychelles came up with a roadmap designed to guide the sector in sustainable growth up to 2030, focused on the opportunities emerging as the world removes restrictions through innovation and collaboration at the national, regional, and international levels, based on the top five key areas. These five priorities are unlocking growth through investment and effective public-private partnerships, promoting innovation and technology, visa facilitation and enhanced connectivity, advocating for an African brand, and fostering greater resilience, including improved tourist safety and security. To mitigate the current and future impact of this pandemic, the willingness and commitment of all tourism countries are imperative to bring about tangible results. To emerge stronger after the COVID-19 crisis, tourism countries should continue to enhance collaboration to emerge stronger after the COVID-19 crisis."

Figure 1-12: Cuisine Resort - a private conservation sanctuary since 1992

1.10 Fisheries sector

The fisheries sector, comprising the industrial fishery, semi-industrial fishery, artisanal fishery, and an aquaculture subsector, is another critical essential pillar of the Seychelles' economy. It accounts for the employment of approximately 17 percent of the total population, while marine-related exports accounted for roughly 98 percent of all goods exported in 2019. Seychelles intends to continue fostering growth within the fisheries sector by adding more incredible value. Developing the aquaculture sector in Seychelles will help bring about more fantastic additions to the supply volumes and diversifications in seafood products available to the value chains. The fisheries sector has three main components: artisanal fisheries, carried out by local fishers, with small, motorized boats targeting mainly demersal and semi-pelagic species; semi-industrial fishery, locally-owned long-liners targeting pelagic species (mainly primarily tuna and swordfish); and industrial fishing, comprising foreign-owned purse seiners and large long-liners primarily targeting tuna species (yellowfin and skipjack). There is a fish processing industry, with two fish processing plants producing for both the local market and export, and a sizeable canning factory processing an average of 350 tonnes of tuna daily, mostly mainly for the export market.

Figure 1-13: Fishing in Seychelles

1.10.1 Sustainable fisheries partnership agreement

On 24 February 2020, the European Union and the Republic of Seychelles signed a new 6-year sustainable fisheries partnership agreement (SFPA) and associated implementing protocol setting out the fishing opportunities for EU vessels, the financial compensation to be paid by the Union, and the modalities of sectoral support to the fishing sector of the Seychelles. The current protocol covers the period 24.02.2020- 23.02.2026 with an EU financial contribution of €5.3

million per year, out of which €2.8 million is earmarked for the support of the fisheries policy of Seychelles. This fisheries agreement allows EU vessels from Spain, France, Italy, and Portugal to fish in the Seychelles' fishing zone. It is part of the tuna network fisheries agreements in the Indian Ocean.

1.10.2 Impact of COVID-19 on Fisheries

With the outbreak of the COVID-19 pandemic worldwide, artisanal fishermen are being encouraged to go out fishing to help sustain Seychelles' food security in this time of the coronavirus (COVID-19) pandemic as an Emergency Plan for Fisheries, aimed at offering some relief to this sector which is being affected by the grappling effects of the pandemic. The implementation of the plan, manned by the Seychelles Fishing Authority (SFA), is aimed at guaranteeing Seychelles' food security amid the COVID-19 pandemic. The plan came into being after the fish processors, in the wake of the COVID-19 pandemic, stopped buying fish from the artisanal fishermen after the closure and reduced activities of hotels and restaurants that usually buy the fish from them.

The semi-industrial fishing sector, which mainly engages in the fishing of tuna for the export market, mainly to Europe and America, had a discussion with all stakeholders to come up with a feasible plan to assist the industry now that the tuna market has closed down.

Currently, there are about 500 artisanal fishing vessels with around 1500 persons employed in the sector. The average catch of demersal fish (deep-sea) every month is 400 tonnes, 50 percent of which was to hotels and restaurants and the other 50 percent on the local market.

1.11 Blue Economy

Seychelles is well-known as a large ocean state with an Exclusive Economic Zone (EEZ) of 1.4 million km². It has embraced the Blue Economy concept, an integrated approach to ocean-based sustainable development. Seychelles is championing the "Blue Economy" as its future sustainable development model. In October 2018, Seychelles launched the World's First Sovereign Blue Bond - a pioneering financial instrument to support sustainable marine and fisheries projects. The blue bond, which raised USD$15 million from international investors, demonstrated the potential for countries to harness capital markets for financing the sustainable use of marine resources and was part of an initiative that combined public and private investment to mobilize resources for empowering local communities and businesses – is intended to assist Seychelles in transitioning to sustainable fisheries and safeguarding its oceans while. At the same time, the Blue Economy is sustainably developed. Success depends on the willingness of stakeholders to fully embrace the Blue Economy concept and ensure that any growth is not at the expense of ocean protection and conservation.

The Blue Investment Fund (BIF) is a loan scheme established by the proceeds of the blue bond. It is intended to support the diversification and expansion of sustainable fisheries value chains in Seychelles. The scheme provides a minimum loan equivalent to US$D10,000 in Seychelles' Rupee to be paid back over 15 years at a 4 percent interest rate. The applicant is required to make a personal contribution of 20 percent of the required amount. The BIF is designed to allow investments in value chains supported by managed fisheries or investments in components of the value chains that will add value without creating additional pressure on vulnerable fish populations.

Meanwhile, the Blue Grants Fund (BGF) also provides access to funds for projects targeted towards sustainable marine development through enhanced value chain and ocean conservation. Proceeds from the bond will include support for expanding marine protected areas, improved governance of priority fisheries, and the development of marine protected areas, improved governance of priority fisheries, and developing Seychelles' Blue Economy. The Blue Grants Fund and Blue Investment Fund are managed respectively by the Seychelles' Conservation and Climate Adaptation Trust (SeyCCAT) and the Development Bank of Seychelles (DBS).

1.12 Financial sector

Another vital pillar of the Seychelles' economy is the financial sector, the most dynamic sector with a growing selection of financial products and services. One of the key critical factors leading to the country's ascent into the global financial services scene has been its success in creating a legal framework that is sound, reliable, and attractive to investors. In 2017, the Central Bank of Seychelles (CBS) developed and launched a National Financial Education Strategy (NFES), which was intended to improve the level of financial capability of Seychellois, thereby facilitating the further deepening of the financial sector, the accumulation of assets and economic growth.

1.13 Employment

The sectoral developments being undertaken in Seychelles require a skilled labor force. Economic growth brings about many opportunities, particularly for employment. In 2019, Seychelles experienced a low unemployment rate of 2.9 percent. This was the result of the numerous policies and schemes implemented by the Employment Department.

However, the informal sector remains a challenge in Seychelles. The informal employment rate for 2019 stood at 15 percent, slightly lower than the rate observed in 2018 (16.5 percent). To address the informality issue, the Government has announced plans to broaden the tax base by capturing the informal sector while maintaining the tax burden on the formal sector at a reasonable level.

1.14 Development challenges

While the immediate national priority is the containment of COVID-19 and recovery from its economic and social impact, a focus on longer-term structural issues is also warranted for a strong and resilient recovery.

Among Seychelles' development challenges is the importance of focusing on raising its economy's productivity, participation, and performance to increase shared prosperity. Some of the main leading institutional challenges in this regard are notably barriers to opening and operating businesses, inefficiencies in the public sector management, such as limited statistical capacity, the need for a broader scope for a more strategic and sustainable approach to social protection, as well as the need to broaden access to quality education and skills development. Climate change adaptation, including strengthened disaster preparedness systems, is also crucial.

Currency	Seychellois rupee (SCR, SR)
Fiscal year	calendar year
Trade organisations	AU, AfCFTA (signed), WTO, COMESA, SADC
Country group	• Developing/Emerging[1] • High-income economy[2]
Statistics	
GDP	• ▲$1.583 billion (nominal, 2018 est.)[3] • ▲$2.901 billion (PPP, 2018 est.)[3]
GDP rank	• 170th (nominal, 2018) • 168th (PPP, 2018)
GDP growth	• 4.3% (2017); 4.1% (2018) • 3.5% (2019e);10.8% (2020f)[4]
GDP per capita	• ▲$16,575 (nominal, 2018 est.)[3] • ▲$30,383 (PPP, 2018 est.)[3]
GDP per capita rank	• 48th (nominal, 2018) • 46th (PPP, 2018)
GDP by sector	• agriculture: 2.5% • industry: 13.8% • services: 83.7% • (2017)[5]

1.15 Water Sector

Water security is one of the most tangible and fastest-growing social, political, and economic challenges many countries face. Seychelles is no exception. The demand for water in Seychelles has increased significantly in the past ten years due to growing demand from both industrial and domestic sectors. This results from an increase in water consumption due to increases in the number of households, the number of tourism establishments, and the number of tourists arriving.

In Seychelles, the government is committed to providing access to drinking water and appropriate sanitation to all citizens access to drinking water and proper sanitation. Over 97% of households in Seychelles have access to potable water, but the government aims to achieve over 99% access.

For a small island nation like Seychelles, water consumption and water demand are relatively high, with 11.4 billion liters of water annually. This will not be sustainable in the future. The Public Utilities Corporation (PUC) has to make available 43,000 cubic meters of water daily for both the domestic and commercial sectors on Mahé, Praslin, and La Digue. Water demand is increasing annually by 5%, and this cannot continue.

The ability of the Seychelles' Government to meet the excess demand for potable water is further aggravated by more extended periods of drought due to climate change. Desalination plants have been installed to meet the shortfall in demand during the dry season. According to the Water Development Plan 2010, the unmet demand for Seychelles is estimated at 40%, hence the need for a better water storage facility. The outlook bears potential for crisis and conflict if the water situation remains the same. The outlook bears the potential for crisis and conflict if the water situation remains unchanged. Water lies at the heart of everything necessary for human life: food, sanitation, energy, producing goods, transport, and the environment. It is important to note that water ensures the mere survival of humans, social well-being, and economic growth. This is the main reason for the construction work to raise Seychelles' main reservoir, the La Gogue Dam, by six meters that began in November 2019. The project will increase the dam's water storage capacity. This, in turn, will increase the country's water supply.

China's Sinohydro Corporation is in charge of the dam built in 1969 in the northern Mahe district of Anse Etoile. Once completed in June 2021, the reservoir's capacity will increase to a total storage capacity of 1.6 million cubic meters; that is, corresponding to an increased water storage capacity of 60%, which is an additional 600,000 cubic meters of water.

A new water treatment in the works plan is being built as one of the projected facilities. The planned facility will be able to treat 4,400 cubic meters of water daily. As a result, the northern region will have a guaranteed water supply. The La Gogue drinking water project will require an investment of $USD 13.6 million USD. The Government of Seychelles is providing financing for the project with the help of a loan from the African Development Bank (AfDB).

This is the reason the government recognizes that an Integrated Water Resource Management (IWRM) needs to be fully implemented to ensure that future water resource demands are equitable, meant for all sectors of the economy, and to promote equity in terms of access to and benefit from the water resources, hence the new water policy.

Figure 1-14: La Gogue Dam on Mahe Island

1.16 Health Sector

Climate change will affect the occurrence of diseases in Seychelles, and a few recent crises (e.g., the dengue fever and the COVID-19 pandemic) signaled the need to adapt proactively. The Department of Health (DOH) is finalizing a sectoral strategy to mainstream climate change in the health sector.

The Government of Seychelles is committed to providing quality health care to the people. The public health system in Seychelles is decentralized. There are six hospitals in total. The Seychelles' health system is a three-tier system comprising of a central referral hospital which resonates from the Seychelles Hospital, followed by cottage facilities (Anse Royale Hospital, Family Hospital at Perseverance, Logan Hospital of La Digue, Baie Ste Anne Hospital on Praslin), the rehabilitative facility (North East Point Hospital), the mental and youth hospitals in the second tier, and district health centres across the republic. There are 17 health centers in the districts that provide primary health care services such as family planning, ante and post-natal care, vaccination services, school health services, physiotherapy, and dental treatment. The private sector also plays a crucial role in improving access to healthcare. There are 16 private clinics providing general medical, 8 eight dental care, and 22 private pharmacies.

The Government of Seychelles is encouraging private-sector investment within the medical field. Between 2014 and 2017, the government spent USD 8.5 million sending Seychellois overseas for further treatment. Capturing a portion of this market can be very lucrative for the wise investor.

Now that the COVID-19 contagion is showing no sign of declining, Infection Prevention and Control (IPC) is ever gaining ground here and abroad. It is now among the priority prevention and control programs of the Department Of Health (DOH). Its aim is to protect health workers and patients alike and keep infections at bay.

Seychelles owes part of its COVID-19 success story to the intense, relentless, and rigorous training provided by the IPC team over the past six months.

The team trains colleagues and builds the necessary synergy for infection prevention and control across the health system and beyond.

Members of the public are constantly reminded to continue practicing preventive measures to ensure that they reduce the risk of infection from the virus. The Health Department also advocated for the public to continue wearing masks on buses and public service areas, a mandatory measure that came into force, as well as in other places where social distancing is impossible. Members of the public are advised to continue to follow public health guidelines.

1.17 COVID-19 Pandemic and Climate Change

The COVID-19 pandemic is the most significant and pressing challenge facing humanity right now, but climate change remains the most significant long-term threat. As a SIDS, Seychelles is looking at ways to bolster its climate efforts. And certainly, from a climate perspective, the virus has opened the eyes of the world to what a global crisis truly looks like.

Like many other SIDS, Seychelles relies on incomes from tourism as the mainstay of its economy. However, the COVID-19 pandemic has grounded airlines and cruise ships and forced the closure of hotels and other tourist-dependent facilities, causing job losses and reduced government revenues, including foreign exchange. The tourism downturn will continue until the health crisis is over.

As Seychelles and the world respond to the demands of COVID-19 for urgent and immediate action, Seychelles is not forgetting that the climate crisis remains and also demands an urgent response.

The planet continues to warm, oceans continue to acidify, sea levels continue to rise, and extreme weather continues to threaten the lives and livelihoods of the people of Seychelles and the world, especially for the SIDS and other vulnerable countries.

Seychelles's lessons from the COVID-19 crisis paved the path to a more resilient future. The crisis has opened up the doorway to a new frontier of multilateralism and international cooperation.

As a result, Seychelles is coming up with an action package encompassing five priority areas built on climate-smart, resilient Seychelles to enable transformation in all aspects, including environmental, economic, and social, with investment support. They are:

1. Accelerate Seychelles' Energy Transition
2. Unlock the Potential of Nature-Bbased Solutions
3. Decarbonize the transport sector through accelerating electric- mobility
4. Install national electric-vehicle charging networks
5. Build climate-resilient coastal infrastructures

This is the time for infrastructure projects that could shield Seychelles from climate change threats. By building seawalls, dykes, artificial reefs, or other coastal protections against growing risks from flooding and sea-level rise, these could save Seychelles substantial amounts of funds that could add to the economy.

While Seychelles had a slight early warning of the COVID-19 pandemic, it has had years of warnings about climate change. Therefore, Seychelles is acting now while it still can to elude the catastrophe of what the runaway climate crisis can cause.

To date, the international commitments to reduce carbon emissions have fallen well short of what would be needed to prevent more than the 1.5 to 2°C rise in global ambient temperature – the stated goal of the Paris Agreement. Countries are expected to update and strengthen their commitments at the Glasgow meeting in December 2020, but COVID-19 has delayed COP26 to November 2021.

Therefore, improving SIDS' resilience to climate change can provide significant opportunities for the national economy in terms of overall sustainable development. This should be considered seriously as the international community comes together to support the post-COVID-19 recovery in ways that are clean, green, healthy, safe and more resilient in clean, green, healthy, safe, and more resilient ways.

1.18 Biodiversity Sector

The Seychelles' archipelago is globally recognized as one of Earth's biodiversity hotspots in terms of its terrestrial and marine ecosystems. Thus, the archipelago is known for its natural beauty and pristine environment. Levels of biodiversity are known to be high, with the most recent overview estimating the presence of 850 plants and 2,426 insect species, although noting that, for at least some islands, insect diversity maybe 3 three times higher than the available estimates.

The biodiversity of the Seychelles' archipelago is recognized to be of international significance, a unique biodiversity characterized within the terrestrial sphere by a high degree of endemism. It is part of the Madagascann and West Indian Ocean Biodiversity hotspot and contains two UNESCO World Heritage Listed Natural biodiversity hotspots and two UNESCO World Heritage-listed natural areas.

The terrestrial land mass of the Seychelles is predominately covered in secondary regrowth forests with 40, 600 ha of forests representing 90% of the total land area. The original flora of the islands was relatively floristically poor, with only 250 species of indigenous flowering plants. The main vegetation types on the granitic islands are coastal plateau, lowland and coastal forests, mangrove forest, riverine forest, intermediate forest, mountain mist forest, and glacis type. On the coral atolls, where water availability is limited, dry woodlands, coastal scrubs, and sparse grasslands are common. Mangrove forests cover quite limited areas, but extensive mangrove swamps can be found in the inner lagoon on the Aldabra Atoll. Extensive mangrove swamps can be found in the inner lagoon on the Aldabra Atoll. Marine habitats include expanses of sea grass, coral reef, and pelagic habitatsea grass, coral reef, and pelagic habitat expanses. The National Biodiversity Centere features an Arboretum, the Aldabra garden, a palm forest, a living collection garden, a Small Islands Developing States' garden, as well as a medicinal plants garden.

The Arboretum, the first of its kind in Seychelles, provides the general public and visiting dignitaries a landmark opportunity to propagate endangered species.

Guided by the SSDS, and as a further measure to conserve Seychelles' natural environment, the National Biodiversity Strategy and Action Plan (NBSAP) was launched in 2015 to address Seychelles' obligations under the Convention on Biological Diversity (CBD). The NBSAP covers a 6-year period (2015-2020) and was prepared through (2015-2020) and was prepared through a process of stakeholder consultation and approval. Crucially, it highlights that climate change is a cross-cutting threat that has enormous implications for the country's terrestrial and marine biodiversitycountry's terrestrial and marine biodiversity status. Several projects are suggested to achieve its NBSAP's objectives, including the: i) integration of biodiversity into existing climate change adaptation programs; ii) strengthening of Seychelles' ability to deal with existing climate threats to biodiversity; and iii) developing a climate change biodiversity impact profile assessment for Seychelles.

The Seychelles National Biodiversity Strategy and Action Plan 2015-2020 (NBSAP) has been prepared through an iterative stakeholder consultation process. The NBSAP addresses Seychelles' obligations under Article 6a of the Convention on Biological Diversity (CBD) and replaces the previous version produced in 1997. This document builds upon a review of its predecessor and preparatory documents addressing financing, capacity building, and climate change-related biodiversity issues. The NBSAP was developed through a truncated process with stakeholder consultations and the development of a draft undertaken in 2012 and 2013. Following an international independent review of the draft, it was decided to re-align its content to the CBD's Aichi Biodiversity Targets, a process which was undertaken in 2014.

Seychelles is home to significant biodiversity with high endemism: 50-85% for different animal groups and approximately 45% for plants in general. It is recognized as a biodiversity hotspot by Conservation International and a centre center of plant biodiversity by the International Union for the Conservation of Nature (IUCN) and the World Wildlife Fund (WWF).

1.19 Seychelles Marine Spatial Plan

The Seychelles Marine Spatial Plan (MSP) Initiative is a process focused on planning for and managing the sustainable and long-term use and health of the Seychelles' Exclusive Economic Zone (EEZ). The EEZ encompasses 1,374,000 km^2 of ocean and 115 islands. The Seychelles Marine Spatial Planning (MSP) Initiative began in early 2014. It is a government-led process to support the sustainable and long-term use and health of the waters throughout Seychelles' 200 nautical mile Exclusive Economic Zone. It is an integrated, multi-sectoral approach to address climate change adaptation, marine protection, and support the Blue Economy and other national strategies. The MSP Initiative is a Government-led process, with planning and facilitation managed by The Nature Conservancy (TNC) and TNC Canada in partnership with the Government of Seychelles – UNDP GEF Programme Coordinating Unit (PCU). Funding for the MSP Initiative is being provided through some grants to the Government of Seychelles and an Oceans 5 grant awarded to TNC. The MSP Initiative is an integrated, multi-sectoral approach to address climate change adaptation and marine protection and support the Blue Economy and other national strategies. The process includes inputs from all significant sectors of Seychelles, including commercial fishing, tourism and marine charters, biodiversity conservation, renewable energy, port authority, maritime safety, and no-renewable resources to develop a comprehensive marine plan with stakeholder input. The two main economic sectors in Seychelles are tourism and fishing, and both are highly dependent on a healthy ocean and a strong economy.

In 2012, the Government of Seychelles set a goal for protected area expansion: 50% of all terrestrial areas and 30% of the (ocean-based)Exclusive Economic Zone, including 15% in 'no take' areas. At that time, more than 47% of the landmass was protected, while only 0.04% of the ocean was. The MSP Initiative uses an ecosystem-based approach to propose new marine protected areas in conjunction with improved management for uses and activities in the 1.37 million square kilometers of ocean. The MSP Initiative uses global best practices, scientific data, local expert knowledge, and stakeholder input to create maps showing how to use the ocean and what we know about its ecology. Funding to support the implementation of the MSP will come, in part, from the Seychelles Conservation & Climate Adaptation Trust (SeyCCAT), operationalized in 2016 as a product of the Seychelles' debt swap.

Seychelles has committed up to 30% of marine protection in its Exclusive Economic Zone (400,000 km2), along with a comprehensive marine spatial plan to ensure species and habitats have long-term protection, improve the resiliency of coastal ecosystems with a changing climate, and provide economic opportunities for fisheries, tourism, and other uses. The 30% designation of the marine protection will be zoned in high and medium biodiversity protection areas - each about 15% of Seychelles' waters - and compatible uses will be identified to align with biodiversity objectives. Once approved, the Seychelles' marine spatial plan will be the second largest in the world.

1.20 Waste Sector

Seychelles generates, on average, 70,000 tonnes of waste per year. Wastes are disposed of in communal bins sites around the islands, and the wastes are collected and transported in refused compactor trucks, the contents of which are then are. The wastes are collected and transported in refused compactor trucks, then transferred to a controlled landfill at Providence. Solid Waste Management (SWM) poses a significant challenge to Seychelles, which also suffers from many of the usual issues associated with managing wastes within a Small Island Developing State (SIDS), such as inadequate lack of funding and & capacity, high costs of transportation, absence of engineered landfills and scarcity of land.

The Ministry of Agriculture, Climate Change and Environment (MACCE) Environment, Energy, and Climate Change is responsible for developing and implementing all waste management policies and legal and regulatory frameworks. The Waste Enforcement and Permit Division of the Environment Department is responsible for creating all policies regarding waste, waste collection, characterization, treatment, and disposal. The Seychelles National Waste Policy 2018-2023 was approved in December 2018, and the overall goal is to ensure that "Waste is managed sustainably, following the set guiding principles and approaches, to protect the integrity of the environment and improve the quality of life in Seychelles ".. "

The MACCE Ministry of Environment, Energy and Climate Change is committed to improving the existing waste management system by implementing waste reduction and recovery strategies, strengthening its institutional and legal framework, and upgrading waste operations in line with international practices.

The Landscape and Waste Management Agency (LWMA) is responsible for cleaning and beautifying Seychelles. It also administers waste management contracts for waste collection, landfill management, and beach and road cleaning in the Seychelles.

A fire that flared up in Landfill 2 at Providence on the evening of Saturday, 19th September 2020, made its way into a saturated Landfill 1, capped with methane, burning through tires and causing thick, billowing, black smoke. The landfill fire had escalated into a level 2 in disaster management response, unleashing a national response. The closure of some schools – two private, six public, and two training centers – and the industrial estate was due to the fumes' health risks. The flames had burned 85 percent of lLandfill 1 and lLandfill 2 at Providence on the eastern coast on the main island of Mahe before it was smothered a week later. The closure of the schools – two private, six public, and two training centers – and the industrial estate was due to the fumes' health risks.

Figure 1-15: Health risk posed by the fumes from the landfill fire

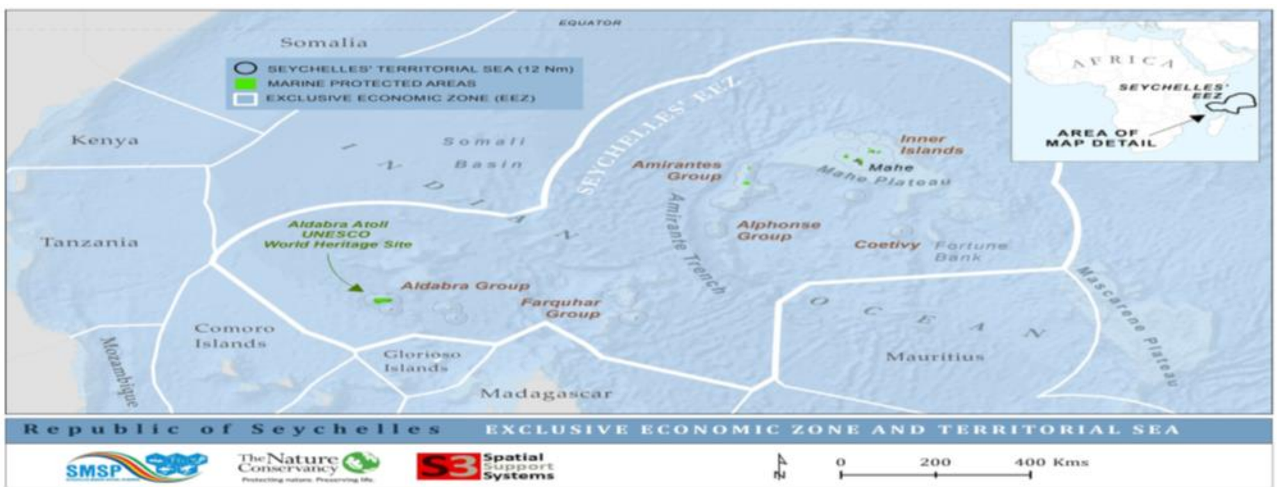


Figure 1-16: EEZ of Seychelles depicting areas to be covered by MSP

1.21 Institutional response to climate change

The Seychelles began its action towards managing the impacts of climate change when it ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. It also established the National Climate Change Committee (NCCC), which provided the overall coordination of the development and implementation of the national climate change program. It has been responsible for preparing the First and Second National Communications for the UNFCCC. The First Initial National Communication (FINC) submitted to the UNFCCC in 2000 assessed the country's context, determined the countriesy's vulnerability, identified options for climate change mitigation and adaptation, and highlighted capacity needs and priorities. Although it brought attention to climate change matters in Seychelles, it primarily focused on reporting under the UNFCCC. It had limited relevance to policy decision-making as it was mainly an academic report. The Second National Communication (SNC), submitted in 2011, follows the same structure as the FNC. However, it offered strategic policy support by recommending i) the institutionalization of climate change responses, ii) the production of knowledge and information for national priorities, iii) a mechanism of policy dialogue for effective practical actions, and iv) public education and awareness campaigns for mainstreaming climate change concerns at different levels of society. The SNC, therefore, sought to facilitate policy changes by exploring opportunities for integrating climate change adaptation into priority economic sectors.

By submitting the National Communications, the Government of Seychelles recognizes the importance of urgently adapting to climate change and variability. Since becoming party to the UNFCCC, the Seychelles has signed further climate change-related international agreements, including the Kyoto Protocol in 1998 and the Paris Agreement in 2016. The Seychelles' progress towards creating a legislative and institutional framework for climate change adaptation planning has subsequently increased. Noticeable achievements include the creation of the i)Nationally Determined Contribution, ii) the Seychelles National Climate Change Strategy, iii) the Environmental Management Plan of Seychelles, iv) the Seychelles Sustainable Development Strategy; v) the National Biodiversity Strategic and Action Plan, vi) the National Development Strategy -2020-2024 and vi) the Climate Change Division under the MACCEMinistry of Environment, Energy and Climate Change. In addition, the Seychelles National Climate Change Policy was approved by the Cabinet of Ministers in May 2020 after wider, more comprehensive consultations with relevant stakeholders.

Seychelles submitted its Nationally Determined Contribution (NDC) to the UNFCCC's Secretariat in September 2015. According to the 2015 NDC), Seychelles will reduce its economy-wide absolute GHG emissions by 122.5 ktCO2e (21.4%) in 2025 and an estimated 188 ktCO2e in 2030 (29.0%) relative to baseline emissions. As for adaptation, the NDC is expected to reduce the country's vulnerability while also considering opportunities for remaining a net sink for global emissions. Eight sectors/sub-sectors that are particularly vulnerable to the impacts of climate change are identified in the NDC, namely: i) infrastructure, ii) tourism, iii) food security, iv) water security, v) biodiversity, vi) energy, vii) health, and viii) waste. The total cost of implementing the adaptation components listed in the NDC is estimated at US$D 295 million.

1.22 Institution, Governance and Coordination

In addition to advancing climate change-related policies and plans discussed above, the Seychelles has started creating institutional structures to take responsibility for the overall management of climate change-related matters. The MACCE Ministry of Environment, Energy and Climate Change (MEECC) is responsible for among other things, i) protecting, preserving, and improving the environment, ii) ensuring the supply of safe and affordable water and energy supply, and iii) building resilience to climate change and extreme weather events. In 2015, the MEECC was restructured. This led to the creation of the Climate Change Division (CCD) under the Department of Energy and Climate Change (DECC), which will serve as the national focal point for climate change adaptation and mitigation planning and implementing climate change-related projects. Within the CCD, several sections exist, including the Climate Change Adaptation Section, the Climate Change Mitigation Section, the Climate Science and Data Management Section, and the International Climate Negotiation Section.

In addition to establishing government agencies, the NCCC was established in 1992 as a coordination mechanism to increase stakeholder participation in climate change-related decision-making. The NCCC includes representatives from the public sector and private sectors along with non-governmental organizations (NGOs), and it is responsible for making decisions on all climate change-related matters. As a result, its members have diverse and wide-ranging expertise. However, participation from newly formed NGOs – such as SIDS Youth Aims Hub Seychelles (SYAH-Seychelles) – is currently limited within the NCCC. Involvement The involvement of such groups would assist in keeping the government and other integral partners accountable for national, regional, and international obligations.

1.22.1 Institutional Framework for Preparing National Communication and BUR

Establishing the National Climate Change Committee (NCCC) in 1992 resulted in a multi-stakeholder group chaired by the MACCE. The MACCE functions as the main body to coordinate and monitor the implementation of climate change adaptation and mitigation projects, identify emerging gaps and opportunities for further action, and identify emerging gaps and opportunities for further action. Seychelles has made significant progress on climate change planning and implementation by establishing this national climate change committee and developing a national climate change strategy in 2009.

This committee was involved intensely in preparing the First and Second National Communications and the NDC. It will continue to be involved in the NAP process. The NCCC will be strengthened and supported by the designated Project Steering Committee throughout the project.

To date, individual projects or programs have been managed and monitored on an ad-hoc arrangement by relevant departments, ministries, or agencies. For example, the progress towards the Seychelles' NDC targets is being nationally monitored, reviewed, and reported by the MACCE. However, this monitoring focuses on the short-term monitoring of activities, processes, and outputs rather than on longer-term outcomes. The NCCC is also expected to coordinate and monitor the implementation of National Communications and other climate change projects, including identifying emerging gaps and opportunities for further action. To standardize the monitoring of National Communications initiatives nationally, the Department of Public Administration (DoPA) has established a Monitoring and Evaluation and Administrative Governance initiative across all ministries to facilitate ministry -wide monitoring.

Despite the development of these institutional structures and guiding documents, Seychelles' capacity to implement and execute such policies, plans, and strategies is challenged by limited: i) access to well-organized knowledge to inform the planning of National Communications planning and ii) financial and technical capacities to implement climate change projects derived from National Communications. Furthermore, the national response to climate change is largely project-based, with interventions responding to localized climate change needs.

1.22.2 National Communications and the BUR Governance Structure

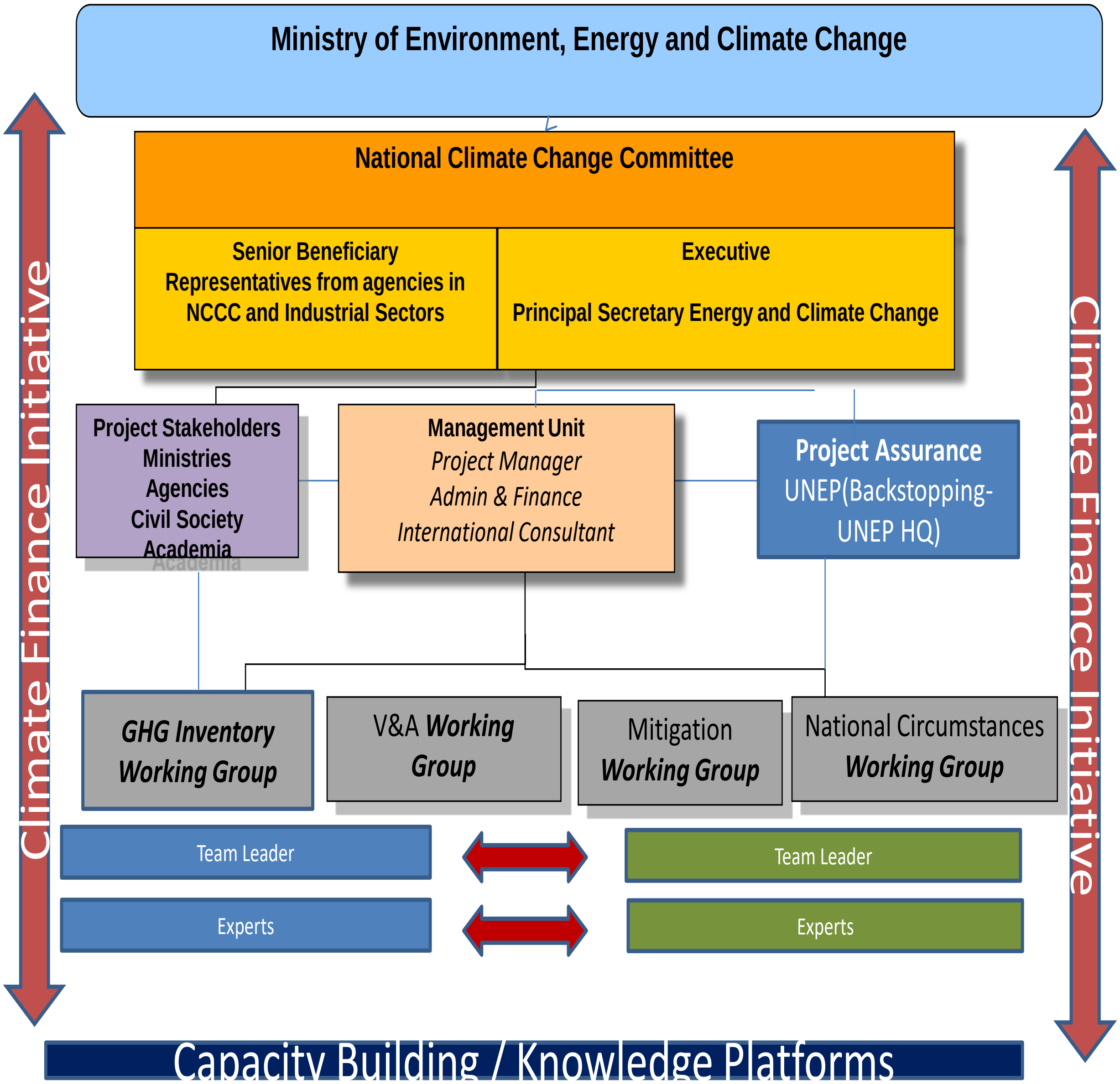


Figure 1-17: Governance structure for the development of the FBUR

1.23 Nationally Determined Contributions (NDCs)

The Republic of Seychelles submitted its first NDCs in 2016 with the goals and targets set for different sectors, including energy, transport, land use, waste management, etc. Seychelles is currently a net sink, and under the Business-As-Usual scenario, it is expected to become a net emitter between 2024 and 2025. However, "Tthe Republic of Seychelles will reduce its economy-wide absolute GHG emissions by 122.5 ktCO2e (21.4%) in 2025 and an estimated 188 ktCO2e in

2030 (29.0%), relative to baseline emissions.", with this contribution Seychelles will remain a net sink till 2030.

Concerning climate change, the biggest, most prominent policy task nations had heading into 2021 was to complete their national climate action plans—or NDCs, and Seychelles had already embarked on this policy task. The NDC preparation plan in 2018 has already contributed to engaging the community, NGOs, and other relevant stakeholders on ambitious actions on climate change. This came from community consultations, parliamentary representatives' meetings, and a documentary on Seychelles' climate and socio-economic realities and its impacts on the EEZ of 1.37 million square kilometers. All these raised the country's consciousness of its communities' vulnerability to climate change. This motivates private businesses and public officials to take ambitious actions to safeguard the government of Seychelles and, at the same time, contribute to reaching the goals of the Paris Agreement.

The crucial year for climate ambition was 2021, with countries submitting their national climate action plans, or NDCs, which happen every five years. Under the Paris Agreement, which is one of the most successful multilateral agreements of modern times and a covenant of hope with the people of the world for a cleaner, greener, healthier, more climate-friendly future, each nation must submit a five-year plan that outlines exactly precisely how they will tackle climate change. In 2020, governments had the opportunity to spell out some of their post-COVID-19 recovery plans and policies in their NDCs, and Seychelles was no exception. Seychelles is mapping its post-recovery plans and discussing economic recovery with the relevant stakeholders and friendly donor countries. This is reinforced by the United Nations' 2030 Agenda, a global plan to tackle some of humanity's most pressing issues. It has to be noted that science has advocated that the window of opportunity to address climate change will likely close in the next five years. So, Seychelles and the rest of the world's nations need incredibly robust plans that spell out some of their post-COVID-19 recovery plans and policies in these NDCs. Seychelles' plan will cover policies addressing emissions and issues related to forestry, land use, coastal zones, water, energy, transportation, and the Refrigeration and Air-Conditioning (RAC) sector. There is a need to complete the unfinished work concerning climate negotiations. Primary among that unfinished work is agreeing on how carbon markets will operate—a big part of the climate change picture. Nations made some progress at COP25, but they are not there yet.

1.23.1 Paris Agreement and the 2030 Agenda for Sustainable Development

Seychelles will use public funds in the future to invest in sustainable sectors and projects that help the environment and the climate. All climate risks and opportunities must be incorporated into the financial system and all public policy-making and infrastructure aspects. There is a need to work together as an international community. The value of multilateralism in a global crisis is unambiguous. If all the nations work together and get it right, global recovery towards a more sustainable and inclusive path is possible. The countries of the world should, therefore, be reminded that a framework for action – the 2030 Agenda for Sustainable Development and the Paris Agreement on Climate Change are already in place to help build a better future.

1.23.2 An Economic Recovery That Builds a Greener Future

NDCs are at the heart of the Paris Climate Change Agreement and embody efforts by each country to reduce national emissions and adapt to the impacts of climate change. Each NDC reflects the country's ambition, considering its domestic circumstances and capabilities, and is updated every five years, starting in 2020.

1.24 Legal and Policy Framework

Seychelles has specific policies and Legislation that are pertinent to climate change governance.

Legislation framing climate change governance in Seychelles

1.	National Parks and Nature Conservancy Act of 1969
2.	The Town and Country Planning Act of 1972
3.	Fisheries Act of 1987 (amended in 2014)
4.	The Constitution of Seychelles of 1993 (Article 38)
5.	Energy Act of 2012
6.	Disaster Management Act of 2014
7.	Environment Protection Act of 1995 (Amended in 2016)
8.	Meteorology Act of 2015
9.	Conservation and Climate Adaptation Trust of Seychelles Act of 2015

Policies, Strategies, and Roadmaps

1.	Seychelles National Climate Change Strategy (NCCS) -2009
2.	Energy Policy of Seychelles - 2010-2030
3.	Seychelles Sustainable Development Strategy (SSDS) - 2012-2020
4.	Intended Nationally Determined Contributions (INDC) - 2015
5.	National Biodiversity Strategy and Action Plan (NBSAP) - 2015-2020

6.	Water Policy - 2017
7.	100% Seychelles Renewable Energy Strategy - 2018
8.	Wetlands Policy and Action Plan - 2018-2022
9.	Blue Economy Strategic Policy Framework and Roadmap - 2018-2030
10.	Coastal Management Plan (CMP) - 2019-2023
11.	Vision 2033 and the National Development Strategy (NDS) - 2019-2023
12.	Shoreline Management Plan for La Digue - 2019-2023
13.	Integrated Shoreline Management Plan for North East Point - 2020-2024
14.	Energy Efficiency Policy – 2020-2024
15.	National Climate Change Policy

1.24.1 National Climate Change Policy 2020

Seychelles' Cabinet of ministers approved the National Climate Change Policy (NCCP) in 2020 to guide all the stakeholders' actions to tackle climate change and to ensure a sustainable future with the vision of "a sustainable, climate-resilient, and low-carbon Seychelles."

The overall objective is to facilitate a coordinated, coherent, proactive, and effective response to climate change's local, regional, and global challenges and opportunities.

It has five specific objectives as follows:

1. To advance understanding of climate change and its impacts on Seychelles.

2. To strengthen capacity and social empowerment at all levels to adequately respond to climate change.

3. To mainstream and integrate climate change considerations into all relevant sectors and all levels of government.

4. To achieve a transition to a low- carbon economy.

5. To put in place measures to adapt, build resilience, and minimize vulnerability to the

Impacts of climate change;

The NCCP will be reviewed every 5 five years, or when viewed as necessary along with the NCCS, to ensure it aligns with other national and international priorities for climate change.

The NCCP establishes a National Climate Change Council as follows:

1. Chaired by the Vice President of Seychelles.

2. The Minister for Agriculture, Climate Change and Environment (MACCE) Energy and Climate Change will be the Vice-Chairperson of the Council.

3. Members of the Council will comprise not more than 15 members appointed by the President.

4. A Secretariat of the Council will be established to support its work.

Members of the Council

- Senior representatives of key government ministries and authorities.;

- Representation of the private sector nominated by the Seychelles Chamber of Commerce and Industry (SCCI).

- Representation of the Civil Society working on climate change nominated by the Citizens Engagement Platform Seychelles (CEPS);

- Representation of youth (between the age of 18 and 30 years old) who have been actively involved in various climate change activities in the community nominated by the Youth Council;

Functions of the Council

Act as the national climate change coordination mechanism with the following Functions:

1. Ensure the mainstreaming of climate change by all of the sectors in their plans, policies, and master plans;

2. Ensure harmonization harmonization between the various development policies, strategies, interventions, and indicators with the NCCP;

3. Ensure and oversee the reporting of all relevant stakeholders and sector actions vis-à-vis climate change and assess whether targets and objectives are being met.

4. Discuss the way forward and make recommendations to the various concerns and constraints concerning Climate Change from the work undertaken by the sectors.

5. Approve and oversee the implementation of the NCCS;

6. Ensure and oversee the reporting of all the reporting of all relevant stakeholders after attending international climate change-related conferences, workshops, and negotiations;

7. Follow up and act upon the outcomes of the climate change-related conferences, workshops, and negotiations;

8. Advise the government on legislative, policy, and other measures necessary for appropriate climate change adaptation and how to attain a low-carbon Seychelles;

9. Coordinate and assess the spending of funds from relevant financial mechanisms, including government funding for climate change adaptation strategies implemented in Seychelles;

10. Approve, consult, and advise on appropriate national public education and awareness initiatives, including disseminating climate change-related data to the public.;

11. Provide the direction on research and training possibilities for young professionals on climate change;

12. Provide guidance on how to review, amend, and harmonize the sector laws and policies to achieve this Policy's objectives;

13. Establish the targets for achieving all of the objectives of this Policy by every stakeholder and sector;

14. Establish the targets for the regulation of greenhouse gas emissions.

1.24.2 Background Information and Institutional Arrangements

The Ministry of Agriculture, Climate Change and Environment (MACCE) is the nodal Ministry in the Government of Seychelles for coordinating and managing climate change-related programmes, actions, and reporting information under Article 4.1 of the Convention. According to the Article, all Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives, and circumstances, shall develop, periodically update, publish, and make available to the Conference of the Parties (COPs), the information following Article 12 of the Convention and decisions of the COPs and related guidelines (UNFCCC, 1992). Accordingly, Parties communicate information on national inventories of greenhouse gases not controlled by the Montreal Protocol, steps taken or envisaged to implement the Convention, and any other information that the Party considers relevant to the achievement of the objective of the Convention and suitable for inclusion in its communication.

Later, through its decision 1/CP.16, paragraph 60, the COPs decided to enhance reporting from Parties not included in Annex I to the Convention, stating that: "Developing countries, consistent with their capabilities and the level of support provided for reporting, should submit biennial update reports containing updates of national greenhouse gas inventories, including a national inventory report and information on mitigation actions, needs, and support received." The decision also states the need to consider national capabilities and financial support to facilitate the timely preparation of biennial update reports. Decision 2/CP.17, Paragraph 41(f) and (g) mandated Non-annex I Parties to submit Biennial Update Reports (BURs) every two years, with the national GHG inventories being not more than four years older than the submission year. In fulfilling these requirements, MACCE, with its cross-ministerial and institutional network, is implementing and executing the matters related to the NCs and BURs.

1.25 Previous submissions

Towards the fulfillment of reporting obligations under the UNFCCC, Seychelles has so far furnished three complete national communications, and this is the first BURs to the UNFCCC:

(i) Initial National Communication (INC) in October 2000, containing the national GHG inventory of 1995.

(ii) Second National Communication (SNC) in December 2011, containing national GHG inventory for the year 2000.

(iii) Third National Communication (TNC) in July 20232, containing national GHG inventory for the year 2018.

(iv) First Biennial Update Report (BUR-1) in September 2022, containing national GHG inventory for the year 2018.

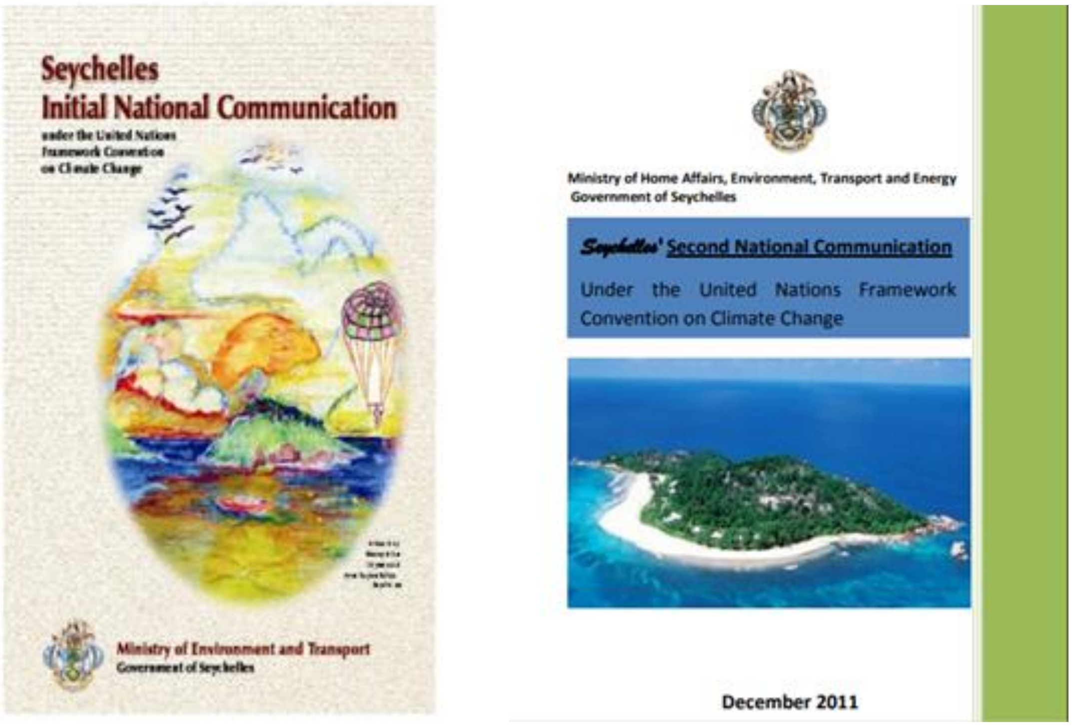


Figure 1-18: Seychelles National Communications

1.26 Measurement, Reporting and Verification (MRV) Institutional Arrangements

For the preparation of National Communications, including the BURs, MACCE set up a National Communication (NATCOM) Project Management Team, which that comprises a Programme Manager, financial officer and an administrative assistant who assist the National Project Director in the compilation of the communications. The current implementation arrangement is depicted in section 4.0. Activities for the preparation of Seychelles' BUR-1 were launched under the GEF-UNEP-GOS project "Preparation of Third National Communication (TNC) and fBUR to the UNFCCC."

For the continuous preparation of National Communications, GoS has taken steps and made efforts towards creating a sustainable institutional structure. Preparation of the BUR required a comprehensive study and technical as well as administrative arrangements, as well as stakeholders' participation in various tasks and activities. To ensure adequate attention and participation, elaborate implementation arrangements have been formulated. The National

Climate Change (Steering) Committee (NCCC), under the chairmanship of the Principal Secretary for the Department of Climate Change and the UNFCCC National Focal Point within the MACCE, oversees the preparation and implementation of the work program of the BUR. Various line Ministries and Government departments most concerned with multiple information elements in this report have representation in the National Steering Committee of the NCCC. The composition of NCCC is provided in Annexure I. Technical consultations on multiple and multidisciplinary aspects of information relating to GHG inventory and mitigation actions were held during the process. Considering the range of requirements, having a Technical Working Group (TWG) to provide technical guidance to prepare the BUR is practical. These working groups have members from the government, academia, and society.

To implement the programs and sustain them, the implementation arrangement, as in Figure 1-9, was proposed to cover all areas of the current setup and the setting up of the MRV system to allow for greater transparency and cater to all possible policy and Nationally Appropriate Mitigation Actions, (NAMA's) likely to be developed in the future as an integrated system for the Seychelles.

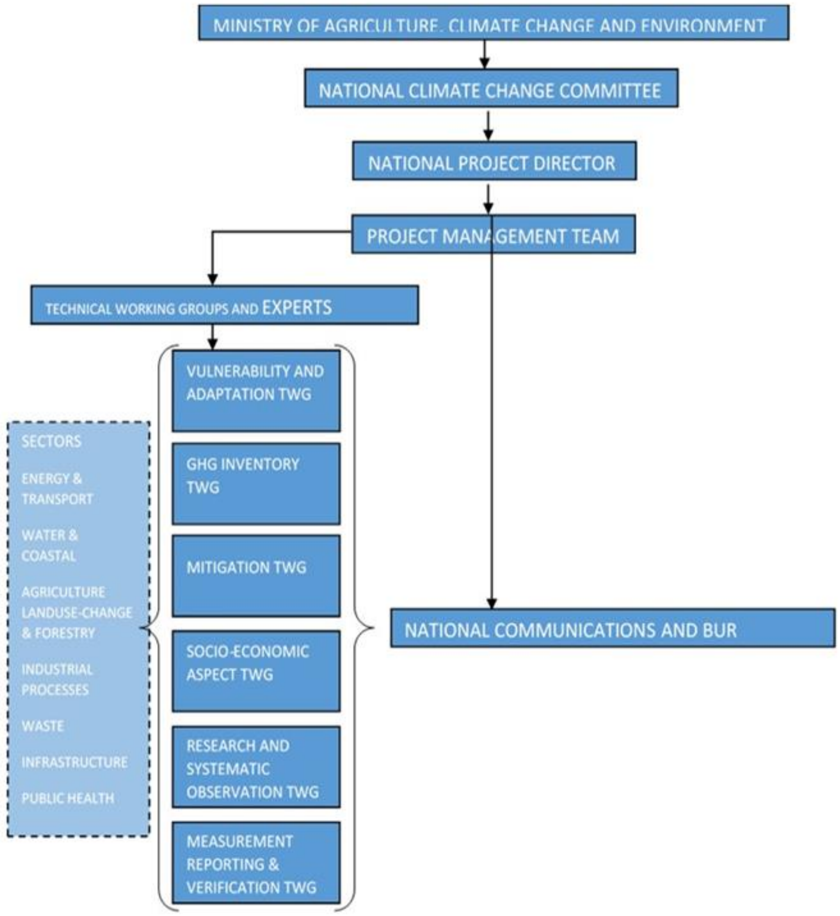


Figure 1-19: Proposed Implementation Arrangement for the first BUR

Several studies were reviewed to accommodate the requisites of this BUR and related events to the Third National Communication. Institutions with sector-specific expertise carried out these studies. Besides, various ministries and government departments provided inputs for preparing this BUR.

1.27 Institutional Network

The Ministry of Agriculture, Climate Change and Environment (MACCE), being the implementing and executing entity, assigned several studies and conducted activities, including workshops and national consultations, to prepare the BUR. The institutional network of the National Communications was also employed for the first BUR. This BUR also includes elements from the studies conducted under the Impacts, Vulnerability, and Adaptation components. Many experts not engaged in preparing BUR also provided their inputs, comments, and feedback. Quality Assurance and Quality Control (QA/QC) and uncertainty analysis were performed at appropriate stages, including during the concerned institutions' data collection and inventory preparation. The expert institutions with the required expertise, relevant ministries, and NGOs have supported the preparation of BUR together. These coordinating and supporting network institutions were developing the necessary technical capacity, especially for the GHG inventory preparation, which Seychelles envisages as a continuous process. Indeed, Seychelles is developing a National Inventory Management System (NIMS) that will coordinate consistently with the supporting institutions with adequate capacity for the constant preparation of National Communications and BURs. Formalizing such an institutional arrangement requires continuous financial, technological, and capacity-building support from international institutions and Annex-I Parties.

CHAPTER 2 GREENHOUSE GAS INVENTORY

2.1. Introduction

Seychelles, as a Party to the United Nations Framework Convention on Climate Change (UNFCCC), is obligated under the Convention to develop, publish, and regularly update the national greenhouse gas (GHG) emission inventory to develop, publish and periodically update the national greenhouse gas (GHG) emission inventory under the Convention. For a non-Annex I Party to the Convention, decisions 1/CP.16 paragraphs 60(a-c) request the GHG inventory be communicated via the National Communication (every four years) and the Biennial Update Report (every two years). Based on its current capabilities and support received, Seychelles has prepared this NIR to accompany the submission of the Third National Communication (TNC) and the first Biennial Update Report (FBUR), which contains updated accounts of net GHG emissions estimates for the period 2000 – 2020 from four major Intergovernmental Panel on Climate Change (IPCC) sectors: Energy; Industrial Processes and Product Use (IPPU); Agriculture, Forestry and Other Land Use (AFOLU); and Waste.

This report and associated tables are submitted to fulfill Seychelles's obligations, in part, under the enhanced NC reporting (Article 12, paragraph 1(a), of the Convention, decisions 1/CP.16 para 60 (a-b) and as part of the preparation of its first BUR consistent with decision 1/CP.16 para 60 (c). The NIR has been prepared per the UNFCCC Guidelines for the preparation of NCs from non-Annex I Parties (decision 17/CP.8) and the UNFCCC BUR guidelines for non-Annex I Parties (decision 2/CP.17 and its annex III).

The GHG emission estimates provided in this report have been compiled following the IPCC 2006 Guidelines for National Greenhouse Gas Inventories (IPCC 2006GL) and the 2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2019) as reference. The purpose of using these Guidelines was to ensure that GHG emission estimates were transparent, complete, consistent, comparable, and accurate (TCCCA) through time and comparable with inventories produced in other countries of similar national circumstances. The estimates in this report form part of Seychelles' TNC and fBUR and will be the subject of future international technical assessment as required under the international consultation and analysis (ICA) process. This is consistent with the modalities and guidelines for ICA (decision 2/CP.17 and annex IV).

The GHG inventory plays a vital role in a broader system of monitoring, reporting, and verification (MRV) of climate change data and information. Figure 8 illustrates how the GHG inventory fits within the context of international and domestic MRV. The inventory is the primary data source for understanding national contributions towards international efforts in limiting GHG emissions. Domestically, it forms the evidence base for National Determined Contribution (NDC) progress tracking, emissions projections, and the basis for policy design on climate change mitigation policy making.

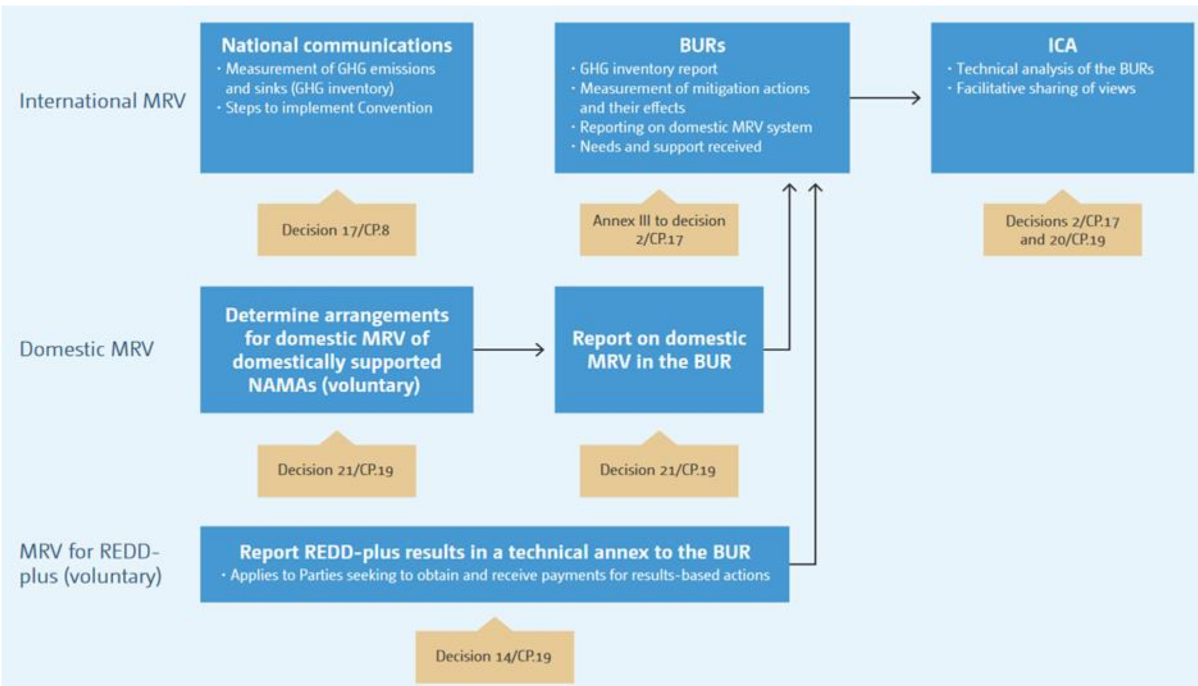


Figure 2-1: Key elements of the MRV framework

2.2. Outline of the National Inventory Report

For clarity, the NIR has been structured in line with the UNFCCC Guidelines for the preparation of national communications from non-Annex I Parties to the Convention (decision 17/CP.8), UNFCCC biennial update reporting guidelines for non-Annex I Parties to the Convention (decision 2/CP.17 and its annex III) and the user manual for the guidelines on national communication from non-Annex I Parties. The NIR consists of six chapters:

Chapter 1 is the introduction to the NIR, highlighting the (a) scope of the GHG inventory, (b) a description of the institutional arrangements including the inventory preparation process and changes to the National System, (c) summary of key methods and data sources, (d) summary of the key category analysis, (e) information on quality control and quality assurance (QA/QC), (f) information on the uncertainty assessment, and (g) an overview of the completeness, recalculations and improvements.

Chapter 2 presents the aggregated national GHG emissions for 2020 and establishes trends in emissions between 2000 and 2020. It also provides a compilation of sector-specific GHG estimates and trends.

Chapters 3 – 6 provide a compilation of sector-specific methodologies and approaches with information on QA/QC, uncertainties, time series consistency issues, recalculations, and improvements.

The Annexes to the NIR also contain more detailed information on the key category analysis for each sector with relevant emissions.

2.3. Scope of the GHG Inventory

The inventory covers sources of GHG emissions that result from anthropogenic activities for direct greenhouse gases, including:

Carbon dioxide (CO2)

Methane (CH4)

Nitrous oxide (N2O)

Hydrofluorocarbons (HFCs)

The inventory also includes estimates of indirect GHGs from a limited number of sectors, including:

Nitrogen oxides (NOX, as NO2)

Carbon monoxide (CO)

Non-Methane Volatile Organic Compounds (NMVOC)

Sulphur dioxide (SO2)

Emissions for each of the direct greenhouse gases have been presented in carbon dioxide equivalent (CO2e) terms using the 100-year global warming potentials (GWPs) contained in the IPCC Fourth Assessment Report (AR4) (2007). Table 3 below illustrates the GWP value used for each gas.

Table 2. 1: Global warming potential (GWP) values applied in the inventory. Source IPCC AR4, 2007

Gas		GWP
Carbon dioxide	CO_2	1
Methane	CH_4	25
Nitrous oxide	N_2O	295
HFC-32	CH_2F_2	675
HFC-134a	CH_2FCF_3	1430
HFC-125	CHF_2CF_3	3500
HFC-143a	CH_3CF_3	4470

The GHG inventory presented in this NIR covers the period 2000 to 2020. This inventory result is an update on the GHG inventory produced for Seychelles' Second National Communication (SNC), published in December 2011, containing the national GHG inventory for 2000. Note that the TNC/fBUR have NIR and GHG estimates are based on the IPCC 2006 Guidelines. The sections below include discussions of recalculated emission values for key critical years (2000 – 2020). The activities included in the GHG inventory represent economic activities at the national scale.

2.4. Institutional Arrangements

The Seychelles' National MRV System for the GHG inventory is still under development. The roles, responsibilities, and legal framework (organizational mandates) supporting the reporting of the GHG inventory will be further formalized through upcoming support programs, including the NDC Partnership Climate Action Enhancement Package (CAEP). The Ministry of Agriculture, Climate Change and Environment (MACCE) is the nodal ministry in the Government of Seychelles responsible for coordinating and managing climate change-related programs, actions, and reporting information under Article 4.1 of the Convention.

This section describes the arrangements that supported the production of this NIR under the GEF-funded TNC/fBUR project. However, it is noted that in some cases, the roles and responsibilities defined under this project were established on a project basis, with ad-hoc data requests made to compile the inventory. They do not necessarily represent the formalized set of long-term mandates supported by a robust legal framework that Seychelles is working towards developing.

To prepare National Communications continuously, the GoS has taken steps and made efforts toward creating a sustainable institutional structure. The preparation of the BUR required a comprehensive study, technical as well as administrative arrangements, in addition to administrative arrangements, and stakeholders' participation in various tasks and activities. To ensure adequate attention and participation, elaborate implementation arrangements have been formulated. The National Climate Change Committee (NCCC), under the chairmanship of the Principal Secretary for the Department of Energy and Climate Change, and the UNFCCC National Focal Point within the MACCE is in place to oversee the preparation and implementation of the work program of the BUR.

To implement the programs and sustain them, the implementation arrangement, as in Figure 1-18 in Chapter 1, was proposed to cover all areas of the current setup and the setting up of the MRV system to allow for greater transparency and cater to all possible policy and NAMAs likely to be developed in the future for an integrated system for Seychelles.

The Ministry of Agriculture, Climate Change and Environment (MACCE) is the designated National Entity for coordinating climate change and hosts the UNFCCC Focal Point. MACCE has overall responsibility for the outputs of the MRV system, including the GHG inventory, NIR, BURs, and NCs. MACCE provides a key critical link between the domestic MRV system, the outside world, and the international community. MACCE coordinates national reporting obligations under the UNFCCC and ensures that outputs are prepared and of sufficient quality to meet Seychelles' commitments.

The Third National Communication and first Biennial Update Report (TNC/fBUR) project has a Project Management Committee (PMT) forming part of the coordination role for the GHG Inventory for the TNC/fBUR. It comprises representatives from national ministries, parastatals, the private sector, and non-governmental organizations. The TNC/fBUR PMT provides a focal point for collaboration around the GHG inventory and climate action and monitoring the MRV system outputs, trends, and challenges. Under the TNC/fBUR project, the PMT is engaged in the review and verification process for the NIR, providing a high-level, interdisciplinary assessment of the inventory and the implications for national climate change mitigation. The PMT is periodically active, dependent on the budget available through project funding.

The Climate Change Committee housed under the Seychelles' MACCE has the Project Management Team (PMT) that oversees the coordination for the compilation of the GHG inventory. The PMT is responsible for managing the GHG inventory compilation process, bringing together the sectoral experts, facilitating the data supply requests from data providers, the day-to-day running of the GHG Inventory Archiving system (see Section above on institutional arrangements), ensuring that sector compilers are meeting deadlines and that project deliverables are submitted to a high standard of quality. The QA/QC coordination role was supported by external consultants, with additional oversight from the PMT for the TNC/BUR1 project. The responsibilities of the QA/QC coordinator included clarifying and communicating distributed QA/QC responsibilities to the inventory compilation team, the development and maintenance of QA/QC activity checklists, the management of the QA/QC timeline, the management of the QA/QC documentation process, and the organization and coordination of external reviews.

The GHG inventory was compiled by a national team of consultants representing various organizations for each sector report. See Figure 2-2 for the full complete list. Within each organization, one or many national consultants were hired to work on the sector GHG inventory under the guidance of an international GHG team-led consultant. Some experts significantly understood national activities within their sectors through previous involvement with national MRV system-related projects. However, some of the experts had to be trained by international consultants if they had no previous prior knowledge of GHG inventories and processes. The national experts were responsible for coordinating data collection with key data providers, compiling the inventory estimates using the compilation tools and templates and the IPCC 2006 Guidelines, assessing the completeness of the compiled inventory, undertaking QA/QC activities on the data, identifying improvements, and providing input into the NIR.

Key data providers for compiling Seychelles' GHG inventory include a range of national government departments, the National Bureau of Statistics (NBS), agencies, and private sector organizations. The data for the inventory were, in most cases, generated for an alternative purpose and adapted for use in the inventory. Private sector input was primarily coordinated by intermediate ministries or departments such as the MACCE and the Seychelles' Energy Commission, which collected data on energy and lubricant use (among other data) as part of the energy balance survey request. Only in a few cases were private sector data providers contacted specifically for direct data submission to the inventory compilation team.

A formal legal framework does not underpin the roles and responsibilities that support the production of the GHG inventory. Many of the roles in the national system, the inventory coordination team, and the PSC, for example, were brought together for the TNC/fBUR project. However, the inventory development was facilitated by certain specific existing mandates and ad-hoc data requests. A summary of sectoral mandates is included in Table 4 below.

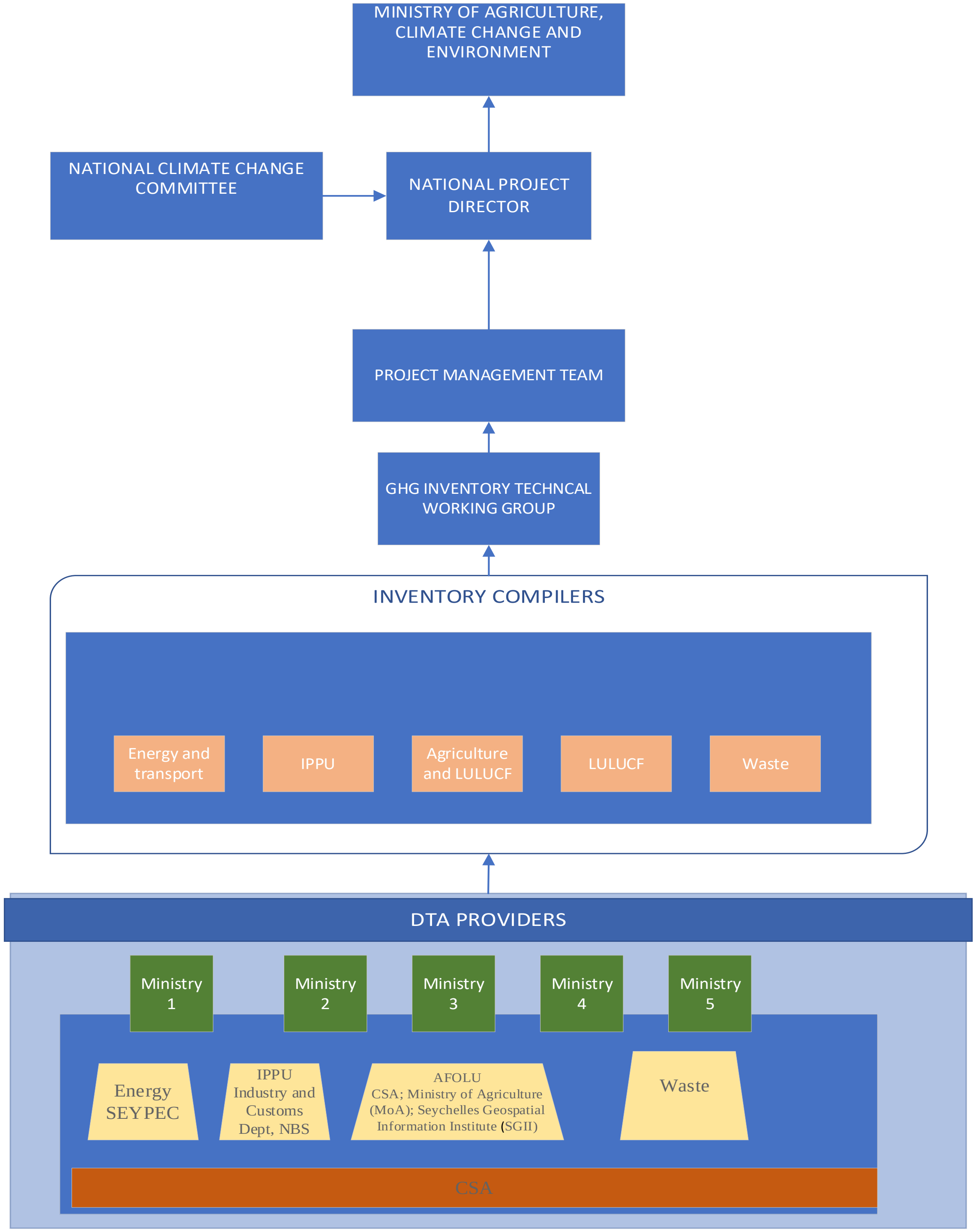


Figure 2-2: Roles and responsibilities structure (proposed GHG institutional arrangements)

Table 2. 2: Roles and necessary capacities of institutions and Individual team members

Title	Responsibility	Necessary Capacities	Position (Organisation)
National entity	Overall responsibility for expected outputs such as NCs and BURs.	Administrative skills, government authority	Ministry of Agriculture, Climate Change and Environment (MACCE)
National Climate Change Committee (NCCC),	Provide overall planning, coordination, management, and technical facilitators of inputs and outputs.	Technical and administrative expertise, government authority	Ministry of Agriculture, Climate Change and Environment (MACCE)
Inventory coordinator	Management of the inventory program and timelines	Technical and administrative expertise, government authority, capacity to coordinate and lead process	Project-based coordinator consultant
QA/QC coordinator	Implementation of QA/QC Plan oversees cross-cutting QA/QC	Quantitative skills, knowledge of the UNFCCC reporting requirements and IPCC methodologies	Project-based coordinator consultant

Table 2. 3: Roles and necessary capacities of institutions and Individual team members across the key emission sectors

Title	Responsibility	Necessary Capacities	Energy	IPPU	Agriculture	LULUCF	Waste	
Inventory compilers (sector experts)	Day-to-day compilation of the GHG inventory and projections for the sector	Quantitative skills, knowledge of the UNFCCC reporting requirements and IPCC methodologies	Ministry of Energy, Energy Commission National Consultant ,	National Consultants	National Consultant and Ministry of Agriculture	National Consultant	National Consultants	
Data providers	Reliable and regular provision of key datasets	Technical skills and legal authority to improve and enhance data collection	Energy Commission, collect data from industry and private sector organizations, National Bureau of Statistics, SEYPEC	National Bureau of Statistics .SEYPEC, Seychelles Revenue Commission (SRC) Industry and Customs	Ministry of Agriculture, Department of Forestry, National Bureau of Statistics, Seychelles Geospatial Unit, Climate Change Dept.		Municipality Managers, Recycling Companies, Wastewater Data Manager, National Bureau of Statistics	

Table 2. 4: Existing legal instruments and mandates supporting the national GHG inventory system

GHG Inventory Sector	Description of existing legal frameworks relevant to the GHG inventory
Energy	The SEC Act mandates energy companies to provide data to the Seychelles Energy Commission. Annual electricity usage data is provided by utility companies and used for the energy balances. Import/export information is provided by SEYPEC. Reporting data on the energy balance is currently voluntary.
IPPU	Existing frameworks for reporting under the Ozone Depleting Substances Regulation (Montreal Protocol), Convention on Long Range Transboundary Air Pollutants (CLRTAP), and the Environment Protection Act (EPA) all provide data that can be leveraged for the GHG Inventory IPPU sector. The NBS, along with the industry and customs , is also a potential data source, especially for solvents and greases.
AFOLU	The Seychelles Parks and Garden Authority and MACCE have mandates to coordinate data collection processes; otherwise, there are no pre-existing data sharing agreements.
Waste	Seychelles has no waste-specific relevant legislation supporting the collection of waste sector data, nor is there a Memoranda of Understanding (MoUs) for data supply with the Municipalities exist. The Landscape and Waste Management Agency was established under S.I 29 of 2009 – of the Seychelles Environment Protection Act (EPA). The Agency is responsible for managing waste and overall landscape development and management of Seychelles. The Government of Seychelles (GoS) has recently strengthened its commitment to improving the existing waste management system by adopting a new National Waste Policy 2018-2023 that outlines the priority objectives and provides direction as to how they should be met. The Seychelles has not yet adopted a dedicated "Waste Management Act" that entirely regulates waste management. However, the process of preparing such framework legislation is currently underway. The Environmental Protection Act (EPA, 2016) is the only environmental Act that regulates waste management, but in a very general and incomprehensive manner. The EPA provides that waste can only be disposed of if authorized by the MACCE. It empowers the Minister to adopt regulations to control waste management that may establish minimum requirements, specify product requirements related to the content of specific substances or recycled materials, and impose a fee on importers or manufacturers of specified materials, products, or goods to cover their disposal costs.

2.4.1. Data collection, processing and storage

The data and information required for compiling national GHG inventories can include data from online data from hard copies of reports and expert judgment information from discussions with national experts. All this information and data must be reviewed and analyzed to ensure they are appropriately and accurately used within the inventory estimates.

Throughout the inventory compilation process, the sector experts applied the good practice guidance from the IPCC Guidelines to review and incorporate data gathered consistently and accurately. All data sets and information used to include a summary of emissions/removal trends and the calculation files have been transparently documented in some cases in Excel spreadsheets and through the use of the IPCC Inventory Software tool that acts as a database and archiving system:

- IPCC Inventory Software

The National experts used the IPCC GHG Inventory Software for the compilation and documentation to compile and document the inventory datasets. Calculations were conducted by the experts using the IPCC Inventory software version 2.691. The IPCC Software was also employed as a database for archiving inventory data sets. Data sets and documentation for all sectors were also managed using the GHG Inventory Archiving Site on a government internal server. Established for the TNC/BUR1 project, this site allows data sharing across government departments to enable data providers to contribute and use the data for specific departmental purposes. The MACCE does not have the means to store data and information that are relevant for producing NCs and BUR/BTRs, and these are as follows;

- Documentation of institutional arrangements for the smooth and regular development of GHG inventories
- Documentation of all stakeholders (such as data providers), including contact information, roles and responsibilities
- Archive of relevant national data (e.g., activity data, emission factors, conversion factors, etc.)

- Documentation of the selection process of national activity data and related parameters used in the inventory preparation process
- Documentation of methodologies and data assumptions used
- Documentation of Improvement Plan
- Documentation of QA/QC Plan, objectives and procedures
- Storage of GHG inventory compilation files and underlying data files
- Excel spreadsheets:

Excel spreadsheets were usedThe experts used Excel spreadsheets for all sectors to calculate background information on parameters and activity data used in the GHG inventory emission estimates, for example, the generation of information on activity data time series derived from remote sensing for the land use, land-use change and forestry (LULUCF) sector or energy balance in the energy sector.

As far as possible, national data sets have been used in the inventory. However, there are instances where the national data sets are not available, and information has been taken from international data sets (as is the case within the energy sector).

Throughout the data collection process, the sector experts have been conscious of the prioritization of categories. These sectors are likely to have a more significant contribution to total national emissions, and therefore are likely to have a more substantial contribution to total national emissions and, therefore, are deemed a higher priority. The data-gathering process has focused on the key categories by putting resources into the investigation and collection of data to support the estimates in the key categories.

2.4.2 Information on Changes to the National System

This section summarises any changes to the systems and administrative arrangements for the compilation of the GHG inventory. Seychelles' former Ministry of Environment, Energy and Climate Change (MEECC) was responsible for among other things i) protecting, preserving, and improving the environment; ii) ensuring the supply of safe and affordable water and energy supply; and iii) building resilience to climate change and extreme weather events. In 2015, the then MEECC was restructured. This led to creating the Climate Change Division (CCD) under the Department of Energy and Climate Change (DECC). Since then, the CCD has that serves as the national focal point for climate change adaptation and mitigation planning and the implementation of climate change-related projects. With a new government in place in 2020, another restructuring led to the MECCC becoming the Ministry of Agriculture, Climate Change and Environment (MACCE). It was restructured, and MACCE now holds a central role as coordinator of the inventory compilation and the QA/QC processes, though it is still project-based.

The most significant change between the compilation of SNC and TNC/fBUR is the program of technical capacity building and training delivered during the compilation of the NIR for the TNC/fBUR project. National consultants received technical training from a team of international and regional consultants with the aim of building national capacity to compile the inventory independently. As a result, a set of institutions that can provide continuity for the inventory has been identified, as listed in Table 2-5 on GHG institutional arrangements above. As part of this capacity capacity-building program, the tools, templates, and systems have also been updated for the compilation of the TNC/fBUR GHG inventory.

2.5 Key Categories

An analysis of the key categories analysis was carried out per the 2006 IPCC Guidelines, providing a useful, valuable analysis of the inventory estimates by highlighting the more significant categories. By highlighting these categories, the inventory compilation team can better assess the prioritization for improvement of data gathering and methodologies improvement. Other inventory users can also clearly identify those categories that may be more applicable for mitigation to reduce national GHG emissions.

There are three ways of determining a key essential category, and they are as follows:

- Level assessment – order the inventory categories from large to small in terms of emissions for a single year and highlight all categories that contribute to 95% of the total emissions

- Trend assessment – order the inventory categories from large to small in terms of their contribution to the total trend and highlight all categories contributing to 95% of the total trend.

- Qualitative assessment – The inventory team identifies categories in addition to those flagged by the Level and Trend assessment that are deemed significant, and this could be due to expected growth or completeness of the inventory.

Key category analysis was carried out using both approaches, 1 (level assessment) and 2 (trend assessment), and the results are shown in Table 2-5 and Table 2-6, respectively. Key categories determined by the Level analysis were primarily dominated by CO2 emissions from the AFOLU and Energy sectors. More than half of the GHG emissions in the key category came from Forest land, Remaining Forest land (3 B1a), and the Energy Industry (1A1). Forest land Remaining Forest land contributed 48% to the key categories. Other sectors in the key category included Land Converted to Settlements (3B5b), road transport (1A3.b), Other Sectors (1.A.4), Solid Waste Disposal (4.A), Water-borne Navigation (1A3d), Land Converted to Cropland (3B2b) and Refrigeration and Air Conditioning (2.F.1).

2.5.1 Level assessment

Table 2. 5: Level assessment results for Seychelles' emissions

IPCC Category code	IPCC Category	Greenhouse gas	2000 Ex,t (Gg CO2 Eq)	|Ex,t| (Gg CO2 Eq)	Lx,t	Cumulative Total of Column F
3.B.1.a	Forest land Remaining Forest land	CARBON DIOXIDE (CO2)	-308.36	308.36	48%	48%
1.A.1	Energy Industries - Liquid Fuels	CARBON DIOXIDE (CO2)	136.60	136.60	21%	69%
1.A.3.b	Road Transportation	CARBON DIOXIDE (CO2)	50.77	50.77	8%	77%
1.A.4	Other Sectors - Liquid Fuels	CARBON DIOXIDE (CO2)	41.35	41.35	6%	84%
3.B.5.b	Land Converted to Settlements	CARBON DIOXIDE (CO2)	27.23	27.23	4%	88%
4.A	Solid Waste Disposal	METHANE (CH4)	26.82	26.82	4%	92%
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CARBON DIOXIDE (CO2)	12.46	12.46	2%	94%
3.C.4	Direct N2O Emissions from managed soils	NITROUS OXIDE (N2O)	10.35	10.35	2%	96%
1.A.3.d	Water-borne Navigation - Liquid Fuels	CARBON DIOXIDE (CO2)	8.92	8.92	1%	97%
1.A.3.a	Civil Aviation	CARBON DIOXIDE (CO2)	7.28	7.28	1%	98%
3.B.2.b	Land Converted to Cropland	CARBON DIOXIDE (CO2)	2.19	2.19	0%	99%
3.C.6	Indirect N2O Emissions from manure management	NITROUS OXIDE (N2O)	1.34	1.34	0%	99%

3.A.2	Manure Management	NITROUS OXIDE (N2O)	1.27	1.27	0%	99%
3.A.2	Manure Management	METHANE (CH4)	1.08	1.08	0%	99%
4.D	Wastewater Treatment and Discharge	METHANE (CH4)	0.92	0.92	0%	99%
4.D	Wastewater Treatment and Discharge	NITROUS OXIDE (N2O)	0.92	0.92	0%	99%
1.A.3.b	Road Transportation	NITROUS OXIDE (N2O)	0.73	0.73	0%	100%
3.C.2	Liming	CARBON DIOXIDE (CO2)	0.48	0.48	0%	100%
1.A.3.b	Road Transportation	METHANE (CH4)	0.41	0.41	0%	100%
2.D	Non-Energy Products from Fuels and Solvent Use	CARBON DIOXIDE (CO2)	0.38	0.38	0%	100%
3.A.1	Enteric Fermentation	METHANE (CH4)	0.33	0.33	0%	100%
1.A.1	Energy Industries - Liquid Fuels	NITROUS OXIDE (N2O)	0.32	0.32	0%	100%
2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	0.27	0.27	0%	100%
1.A.1	Energy Industries - Liquid Fuels	METHANE (CH4)	0.13	0.13	0%	100%
1.A.4	Other Sectors - Liquid Fuels	METHANE (CH4)	0.13	0.13	0%	100%
1.A.4	Other Sectors - Liquid Fuels	NITROUS OXIDE (N2O)	0.09	0.09	0%	100%
2.F.3	Fire Protection	HFCs, PFCs	0.08	0.08	0%	100%
1.A.3.d	Water-borne Navigation - Liquid Fuels	NITROUS OXIDE (N2O)	0.07	0.07	0%	100%
1.A.3.a	Civil Aviation	NITROUS OXIDE (N2O)	0.06	0.06	0%	100%
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	NITROUS OXIDE (N2O)	0.03	0.03	0%	100%
1.A.3.d	Water-borne Navigation - Liquid Fuels	METHANE (CH4)	0.02	0.02	0%	100%
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	METHANE (CH4)	0.01	0.01	0%	100%
3.C.3	Urea application	CARBON DIOXIDE (CO2)	0.00	0.00	0%	100%
1.A.3.a	Civil Aviation	METHANE (CH4)	0.00	0.00	0%	100%

2.5.2 Trend assessment

Forest land Remaining Forest land (3 B1a) had the most considerable contribution to the total trend, at about 48%. This emission trend was followed by Energy Industries (1.A.1) and Road Transportation, which had 21% and 8% each. Other Sectors (1.A.4) Land Converted to Settlements (3B5b), and Manufacturing Industries and Construction (1A2) had the least contribution of all categories in the key category analysis.

Table 2. 6: Trend assessment results for Seychelles' emission

IPCC Category code	IPCC Category	Greenhouse gas	2000 Ex,t (Gg CO2 Eq)	|Ex,t| (Gg CO2 Eq)	Lx,t	Cumulative Total of Column F
3.B.1.a	Forest land Remaining Forest land	CARBON DIOXIDE (CO2)	-308.36	308.36	48%	48%
1.A.1	Energy Industries - Liquid Fuels	CARBON DIOXIDE (CO2)	136.60	136.60	21%	69%
1.A.3.b	Road Transportation	CARBON DIOXIDE (CO2)	50.77	50.77	8%	77%
1.A.4	Other Sectors - Liquid Fuels	CARBON DIOXIDE (CO2)	41.35	41.35	6%	84%
3.B.5.b	Land Converted to Settlements	CARBON DIOXIDE (CO2)	27.23	27.23	4%	88%
4.A	Solid Waste Disposal	METHANE (CH4)	26.82	26.82	4%	92%

1.A.2	Manufacturing Industries and Construction - Liquid Fuels	CARBON DIOXIDE (CO2)	12.46	12.46	2%	94%
3.C.4	Direct N2O Emissions from managed soils	NITROUS OXIDE (N2O)	10.35	10.35	2%	96%
1.A.3.d	Water-borne Navigation - Liquid Fuels	CARBON DIOXIDE (CO2)	8.92	8.92	1%	97%
1.A.3.a	Civil Aviation	CARBON DIOXIDE (CO2)	7.28	7.28	1%	98%
3.B.2.b	Land Converted to Cropland	CARBON DIOXIDE (CO2)	2.19	2.19	0%	99%
3.C.6	Indirect N2O Emissions from manure management	NITROUS OXIDE (N2O)	1.34	1.34	0%	99%
3.A.2	Manure Management	NITROUS OXIDE (N2O)	1.27	1.27	0%	99%
3.A.2	Manure Management	METHANE (CH4)	1.08	1.08	0%	99%
4.D	Wastewater Treatment and Discharge	METHANE (CH4)	0.92	0.92	0%	99%
4.D	Wastewater Treatment and Discharge	NITROUS OXIDE (N2O)	0.92	0.92	0%	99%
1.A.3.b	Road Transportation	NITROUS OXIDE (N2O)	0.73	0.73	0%	100%
3.C.2	Liming	CARBON DIOXIDE (CO2)	0.48	0.48	0%	100%
1.A.3.b	Road Transportation	METHANE (CH4)	0.41	0.41	0%	100%
2.D	Non-Energy Products from Fuels and Solvent Use	CARBON DIOXIDE (CO2)	0.38	0.38	0%	100%
3.A.1	Enteric Fermentation	METHANE (CH4)	0.33	0.33	0%	100%
1.A.1	Energy Industries - Liquid Fuels	NITROUS OXIDE (N2O)	0.32	0.32	0%	100%
2.F.1	Refrigeration and Air Conditioning	HFCs, PFCs	0.27	0.27	0%	100%
1.A.1	Energy Industries - Liquid Fuels	METHANE (CH4)	0.13	0.13	0%	100%
1.A.4	Other Sectors - Liquid Fuels	METHANE (CH4)	0.13	0.13	0%	100%
1.A.4	Other Sectors - Liquid Fuels	NITROUS OXIDE (N2O)	0.09	0.09	0%	100%
2.F.3	Fire Protection	HFCs, PFCs	0.08	0.08	0%	100%
1.A.3.d	Water-borne Navigation - Liquid Fuels	NITROUS OXIDE (N2O)	0.07	0.07	0%	100%
1.A.3.a	Civil Aviation	NITROUS OXIDE (N2O)	0.06	0.06	0%	100%
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	NITROUS OXIDE (N2O)	0.03	0.03	0%	100%
1.A.3.d	Water-borne Navigation - Liquid Fuels	METHANE (CH4)	0.02	0.02	0%	100%
1.A.2	Manufacturing Industries and Construction - Liquid Fuels	METHANE (CH4)	0.01	0.01	0%	100%
3.C.3	Urea application	CARBON DIOXIDE (CO2)	0.00	0.00	0%	100%
1.A.3.a	Civil Aviation	METHANE (CH4)	0.00	0.00	0%	100%

Notes

Lx – Level assessment for source or sink

Ex – Absolute value of emission or removal

t – Refers to the inventory year 1.5

Quality assurance and quality control (QA/QC) are key vital components of ensuring that a sustainable inventory system develops high-quality outputs that meet the international and national reporting requirements, and consider the following quality elements as provided in the IPCC Guidelines:

- Transparency – comprehensive and clear documentation

- Completeness – inventories include all present sources and sinks
- Comparability – inventories use international reporting methods and formats
- Consistency – inventories use methods and data consistently across years
- Accuracy – inventories minimise minimize over- and under-estimates of emissions

Together, these are known as the TCCCA principles. Throughout the compilation of a GHG inventory, QA/QC activities are performed by inventory compilers and, where applicable, inventory QA/QC and inventory coordinators. These activities are designed to meet a set of quality objectives that are designed to meet this overarching requirement for high-quality outputs.

These quality objectives and activities are outlined in a QA/QC Plan, which should also include a work plan designed at the beginning of each inventory cycle. Seychelles will develop a QA/QC Plan for the compilation of the inventory under the fBUR/TNC project. The entire plan will be handed over to the MACCE by the consultants and should be stored on a GHG Inventory Archiving Site. The plan will include:

- Defined roles and responsibilities as described above under Institutional Arrangements, defining which organisations organizations contribute to the GHG Inventory compilation process in terms of data provision, calculations, and compilation, QA/QC and review, and coordination of the project.
- Work Plan outlining the steps required to produce the inventory, set deadlines and milestones, and assigns responsibility for tasks.
- QA/QC Objectives defined at the start of the inventory compilation process, listing high are defined at the beginning of the inventory compilation process, listing high-level objectives of the QA/QC system. Table 8 lists the objectives developed under the BUR1/TNC project, which are also available on the GHG Archiving site. In practice, the aim of the quality system is to maintain and improve the qualit at all stages of the inventory work, in accordance with decision 19/CMP.1. Therefore, the QA/QC plan will seek to translate the TCCCA principles into practical actions at

every stage of the inventory process. The TCCCA principles are interrelated and applied at various levels in data gathering, estimation, and reporting.

- QA/QC Activities defined during the compilation process, based on the UNFCCC Annex I Review Handbook and input were defined during the compilation process based on the UNFCCC Annex I Review Handbook and input from national and international experts. The expert group should review the quality activities throughout the compilation process to ensure they are being performed. The cross-cutting and sector-specific activities are available in each sectorial chapter.

Table 2. 7: High level QA/QC objectives

TCCCA Principle	Quality objective	Description of activity
Transparency	The estimates are transparent and accompanied by precise, and up-to-date descriptions of methodologies, data sources, assumptions, models, and underlying assumptions in sufficient category and subcategory detail.	Regularly review and improve the transparency of the inventory reports and associated data.
Transparency	The use of IE (or aggregation of required categories or gases/pollutants) and other notation keys is kept to a minimum, and the percentage of "IE" and/or aggregation and "NE" is reduced compared to previous submissions.	Analysis of Notation Keys. Are IEs and aggregations in the inventory compared to the required reporting breakdown? Calculate the % of IEs or aggregations compared to data values. Are uses of NE justified? Are uses of NO legitimate? E.g., highlight where the number of IEs used in reporting is < 5% of the total data entries.
Transparency	Recalculations are fully justified as improvements in accuracy.	Make sure all differences/changes are fully justified as accuracy improvements, which is documented in the methodology sections and the inventory report.
Transparency	Transparency in time series and methodology consistency, completeness, and accuracy issues are clearly highlighted, and improvements are listed in the improvement plan.	Check that any time series dips and jumps, methodology assumptions consistency issues, completeness and accuracy issues are clearly highlighted, and improvements are listed in the improvement plan.
Transparency	The QA/QC plan is adequately described (internally and externally (in inventory reports)) and fully implemented, there is transparent documentation of QA/QC activities, and QA/QC findings are acted on.	Regularly review the QA/QC plan, its implementation, documentation, and summaries. Is it appropriate to meet the QA/QC objectives? Is it transparently described in the plan and summarised in the national inventory reports? Check that QA/QC findings go into the improvement log. Check that there is a list of improvements and refinements for the QA/QC system in the improvement log.
Completeness	The estimates include values for all required categories, years, gases, and pollutants separately.	Check that there is an estimate or valid notation key for all categories, subcategories, fuels, and expected activities (including new and emerging categories/fuels/activities). Check against reporting template categorization and against the detailed breakdown for previous submissions. Check changes in the estimates comparing the previous submission data-sets to the current submission data-sets. Check for and remove blank cells and "0"s and ensure that NEs have full justification. Sector -specific checks will need to be defined to allow sector experts to undertake this activity.
Completeness	All activity data is representative of the national territory and does not miss out on areas or regions.	Check that activity data received represents the national territory by asking data suppliers to confirm and cross-checking with internationally submitted data-sets.

TCCCA Principle	Quality objective	Description of activity
		Sector-specific checks will need to be defined to allow sector experts to undertake this activity.
Completeness	The submission includes the complete set of inventory calculations, methods, and trend descriptions and all mandatory and non-mandatory accompanying sections (e.g., key categories analysis, Kyoto Protocol accounting, results of uncertainty, and sensitivity analysis).	Submission-specific checks. See the specific checklist.
Consistency	The time series and method application are consistent, there are no method-related dips and jumps in the data and all gases/pollutants are compiled using consistent methods.	Check that all significant dips and jumps are fully justified. Check that methods for different pollutants and inventories use consistent assumptions and activity data.
Consistency	Estimates are consistent with other related data-sets (e.g., plant-specific data reported under other regulations) or differences explained.	Check estimate totals for relevant categories that match or have justifiable differences.
Comparability	The most up-to-date reporting templates are used, and the cells are filled with estimates with suitable category and subcategory detail (e.g., NFR/ IPCC level 3 or 4) provided and minimal use of "IE," no blank or "0" cells and fully justified "NE."	Check that the inventory reports use the most up-to-date templates and that these are appropriately completed.
Accuracy	Methods, data sources, and assumptions result in accurate estimates (e.g., correct application of techniques and assumptions and that all activity data/statistics are included in the estimates accurately).	For key categories, check that all estimates are accurately compiled in accordance with the appropriate IPCC Guidelines decision trees e.g., appropriate Tier 2 or higher methods. Any Tier 1 methods used for key categories are fully justified. Any recalculations represent an improvement in the accuracy of the estimates. For non-key categories, check that all estimates are calculated using appropriate Tier 1 or higher methods and that any recalculations represent an improvement to the accuracy of the estimates. Review and check that sensitivities and uncertainties are reasonable compared with other approaches and possibly compared with other countries. Arrange peer/expert/bilateral review of methods for key and non-key categories. Check that available country-specific data are applied correctly and that estimates are not over or under-estimating. Focus reviews on new or unreviewed estimates first and then a rolling cycle of update reviews to check no new science/knowledge (e.g., different assumptions,

TCCCA Principle	Quality objective	Description of activity
		emission factors) could improve the estimates. Check that essential technologies and policies are accurately reflected in the estimates where expected.
Accuracy	All category, subcategory implied emission factors are within the expected ranges and where appropriate show expected % reductions considering assumptions on abatement/fuel switching included in the emission estimates.	Check that all implied emission factors are within acceptable ranges by comparing with previous submissions, within the time-series they are in and if possible, with other independent (other country) data (e.g. through bilateral reviews).
Accuracy	Data suppliers agree with assumptions and emissions estimates derived using their input data-sets. All stakeholders are aware of and support the emissions estimates.	Ensure a dialogue with country-specific data suppliers who regularly (ideally before submission) show and explain the use of their data in the estimates, including all assumptions and methods used. Ensure that data suppliers of country-specific data provide positive feedback on the application of their data. Focus on key categories.
Accuracy	There are verification activities that show agreement with estimates and/or provide recommendations for further research into differences and/or improvements.	If possible, use independent data (e.g. measurements or estimates of emissions modelled from measurements) to provide independent verification of emission totals and trends.
Accuracy	There is continuous improvement and implementation of all review recommendations.	There is an active improvement log which contains a full list of improvements collected from a wide range of QA/QC activities and review analysis. There is evidence this improvement plan is active and actions on it are implemented and to improve the inventory.
Transparency Consistency Comparability Completeness Accuracy	The estimates have been reviewed by the National Steering group and the Ministry	The estimates have been prepared and presented to the Steering Group and the Ministry for review and, if applicable, has undergone public consultation.

2.6 Uncertainty Analysis

The sector method descriptions highlight sector-specific qualitative assessments of uncertainty and sources of potential error. This NIR does not include a quantitative uncertainty analysis of Seychelles' GHG inventory due to a lack of available uncertainty estimates with the national activity datasets. However, the Party used the IPCC inventory software; therefore, an uncertainty analysis was undertaken using the Approach 1 (error propagation) method described by the IPCC. Approach 1 provides estimates of uncertainty by GHG according to the IPCC sector. Uncertainties analysis was performed in the IPCC Inventory Software Version 2.691.7327 employing an error propagation approach (Table 2-8).

Table 2. 8: Summary of uncertainty analysis using the Approach 1 (error propagation)

2006 IPCC Categories	Gas	Base Year emissions or removals (Gg CO2 equivalent)	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)	Contribution to Variance by Category in Year T
1.A - Fuel Combustion Activities						
1.A.1.a.i - Electricity Generation - Liquid Fuels	CO2	136.60	5.00	6.14	7.92	0
1.A.1.a.i - Electricity Generation - Liquid Fuels	CH4	0.13	5.00	228.79	228.84	0
1.A.1.a.i - Electricity Generation - Liquid Fuels	N2O	0.32	5.00	228.79	228.84	0
1.A.2 - Manufacturing Industries and Construction - Liquid Fuels	CO2	12.46	5.00	5.00	7.07	0
1.A.2 - Manufacturing Industries and Construction - Liquid Fuels	CH4	0.01	5.00	5.00	7.07	0
1.A.2 - Manufacturing Industries and Construction - Liquid Fuels	N2O	0.03	5.00	5.00	7.07	0
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CO2	81.07	5.00	4.17	6.51	0
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	CH4	0.01	5.00	100.00	100.12	0
1.A.3.a.i - International Aviation (International Bunkers) - Liquid Fuels	N2O	0.68	5.00	150.00	150.08	0
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CO2	7.28	5.00	4.17	6.51	0
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	CH4	0.00	5.00	100.00	100.12	0
1.A.3.a.ii - Domestic Aviation - Liquid Fuels	N2O	0.06	5.00	150.00	150.08	0
1.A.3.b - Road Transportation - Liquid Fuels	CO2	50.77	5.00	3.07	5.87	0
1.A.3.b - Road Transportation - Liquid Fuels	CH4	0.41	5.00	244.69	244.74	0
1.A.3.b - Road Transportation - Liquid Fuels	N2O	0.73	5.00	209.94	210.00	0
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	CO2	459.76	5.00	4.30	6.60	0
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	CH4	1.08	5.00	50.00	50.25	0
1.A.3.d.i - International water-borne navigation (International bunkers) - Liquid Fuels	N2O	3.69	5.00	140.00	140.09	0
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CO2	8.92	5.00	4.30	6.60	0
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	CH4	0.02	5.00	50.00	50.25	0
1.A.3.d.ii - Domestic Water-borne Navigation - Liquid Fuels	N2O	0.07	5.00	140.00	140.09	0
1.A.4.a - Commercial/Institutional - Liquid Fuels	CO2	32.53	5.00	6.14	7.92	0
1.A.4.a - Commercial/Institutional - Liquid Fuels	CH4	0.11	5.00	200.00	200.06	0

1.A.4.a - Commercial/Institutional - Liquid Fuels	N2O	0.08	5.00	228.79	228.84	0
1.A.4.b - Residential - Liquid Fuels	CO2	8.82	5.00	6.14	7.92	0
1.A.4.b - Residential - Liquid Fuels	CH4	0.02	5.00	200.00	200.06	0
1.A.4.b - Residential - Liquid Fuels	N2O	0.01	5.00	236.36	236.42	0
2.D - Non-Energy Products from Fuels and Solvent Use						
2.D.1 - Lubricant Use	CO2	0.38	10.00	0.00	10.00	0.000257323
2.D.2 - Paraffin Wax Use	CO2	0.00	10.00	0.00	10.00	2.97777E-08
2.D.4 - Other (please specify)	CO2	0.00	0.00	0.00	0.00	0
2.F - Product Uses as Substitutes for Ozone Depleting Substances						
2.F.4 - Aerosols	CH2FCF3	0.00	10.00	10.00	14.14	0
2.F.4 - Aerosols	CH3CHF2	0.00	10.00	10.00	14.14	0
2.F.4 - Aerosols	CF3CHFCF3	0.00	10.00	10.00	14.14	0
2.F.4 - Aerosols	CF3CH2CF2CH3	0.00	10.00	10.00	14.14	0
2.F.4 - Aerosols	CF3CHFCHFCF2CF3	0.00	10.00	10.00	14.14	0
2.F.4 - Aerosols	CHF2CH2CF3	0.00	10.00	10.00	14.14	0
2.F.5 - Solvents	CF3CH2CF2CH3	0.00	10.00	50.00	50.99	0
2.F.5 - Solvents	CF3CHFCHFCF2CF3	0.00	10.00	50.00	50.99	0
2.F.5 - Solvents	C6F14	0.00	10.00	50.00	50.99	0
3.A - Livestock						
3.A.2.a.ii - Other cattle	CH4	0.00	0.00	0.00	0.00	0
3.A.2.h - Swine	CH4	0.43	0.00	0.00	0.00	0
3.A.2.h - Swine	N2O	1.27	0.00	0.00	0.00	0
3.A.2.i - Poultry	CH4	0.65	0.00	0.00	0.00	0
3.B - Land						
3.B.1.a - Forest land Remaining Forest land	CO2	-308.36	0.00	0.00	0.00	0
3.B.2.b.i - Forest Land converted to Cropland	CO2	2.19	0.00	0.00	0.00	0
3.B.5.b.i - Forest Land converted to Settlements	CO2	27.23	0.00	0.00	0.00	0
3.C - Aggregate sources and non-CO2 emissions sources on land						
3.C.2 - Liming	CO2	0.48	0.00	0.00	0.00	0
3.C.3 - Urea application	CO2	0.00	0.00	0.00	0.00	0
3.C.4 - Direct N2O Emissions from managed soils	N2O	10.35	0.00	0.00	0.00	0
3.C.5 - Indirect N2O Emissions from managed soils	N2O	0.00	0.00	0.00	0.00	0
3.C.6 - Indirect N2O Emissions from manure management	N2O	1.34	0.00	0.00	0.00	0
4.A - Solid Waste Disposal						
4.A - Solid Waste Disposal	CH4	26.82	0.00	0.00	0.00	0
4.D - Wastewater Treatment and Discharge						
4.D.1 - Domestic Wastewaster Treatment and Discharge	CH4	0.92	0.00	0.00	0.00	0
4.D.1 - Domestic Wastewaster Treatment and Discharge	N2O	0.92	0.00	0.00	0.00	0
5.A - Indirect N2O emissions from the atmospheric deposition of nitrogen in NOx and NH3						
5.B - Other (please specify)						
Total						
		Sum(C): 570.649				Sum(H): 0.000
						Uncertainty in total inventory: 0.016

2.7 Overview of Recalculations, Completeness, and Improvements

2.7.1 Recalculations

There were no recalculations performed in this NIR, since SNC used the 1996 IPCC Guidelines while the TNC used recalculations were performed in this NIR, since SNC used the 1996 IPCC Guidelines while the TNC used the 2006 IPCC Guidelines. This is an area for further capacity building and improvement.

2.7.2 Completeness

The GHG emissions by sources and removals by sinks were compiled using the 2006 IPCC Guidelines for GHG Inventories. This provided an overview of the Tiers or Notation Keys methodology per the 2006 IPCC Guidelines used in the inventory sector compilation. The details of the source/sink categories covered and the methods are presented in Table 2-9. Processed data and information were entered into the IPCC GHG Software (Version 2.691.7327.20936 of January 2020) for both the computation of the inventory and the archiving of data inventory computation and data archiving.

The Tier 1 methodological approach was used by the group of experts in the preparation of the entire inventory. This was due to the lack of disaggregated AD and the country country-specific emission factors (EF). The activity data were provided by government agencies of the respective government departments Government agencies of the respective government departments provided the activity data. Default IPCC EFs and their uncertainties were obtained from the 2006 IPCC Guidelines and the online Emission Factor Database. For the computation of carbon dioxide equivalence (CO2eq), Global Warming Potential (GWP) of CO2, CH4, and N2O data were obtained from the IPCC Fourth Assessment Report (AR4) GWPs.

To improve on the Transparency, Accuracy, Completeness, Comparability, and Consistency (TACCC) principles, all procedures on the selection of selecting AD and EFs were peer-reviewed and documented.

Table 2. 9: Summary of the 2006 IPCC Guidelines methodology Tiers used in the inventory

Source and Sink Category		***Carbon dioxide (CO_2)***				***Methane (CH_4)***				***Nitrous oxide (N_2O)***			
		M	***AD***	***CF***	***EF***	***M***	***AD***	***CF***	***EF***	***M***	***AD***	***CF***	***EF***
1	Energy												
1.A	Fuel Combustion Activities												
1.A.1	Energy Industries	T1	SEYPEC	IPCC	D	T1	SEYPEC	IPCC	D	T1	SEYPEC	IPCC	D
1.A.2	Manufacturing Industries and Construction	T1	SEYPEC	IPCC	D	T1	SEYPEC	IPCC	D	T1	SEYPEC	IPCC	D
1.A.3	Transport	T1	SEYPEC	IPCC	D	T1	SEYPEC	IPCC	D	T1	SEYPEC	IPCC	D
1.A.4	Other Sectors	T1	SEYPEC	IPCC	D	T1	SEYPEC	IPCC	D	T1	SEYPEC	IPCC	D
1.A.5	Non-Specified	T1	SEYPEC	IPCC	D	T1	SEYPEC	IPCC	D	T1	SEYPEC	IPCC	D
1.B	Fugitive emissions from fuels	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.B.1	Solid Fuels	NE	NE	NE	NE	NE	NE	NE	NE	NO	NO	NO	NO
1.B.2	Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.B.3	Other emissions from Energy Production	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
1.C	Carbon dioxide Transport and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.C.1	Transport of CO_2	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.C.2	Injection and Storage	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.C.3	Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2	Industrial Processes and Product Use												
2.A	Mineral Industry												
2.A.1	Cement production	NO	NO	NO	NO								
2.A.2	Lime production	NO	NO	NO	NO								
2.A.3	Glass Production	NO	NO	NO	NO								
2.A.4	Other Process Uses of Carbonates	NO	NO	NO	NO								
2.A.5	Other (please specify)												
2.B	Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B.1	Ammonia Production					NO	NO		NO				
2.B.2	Nitric Acid Production									NO	NO	NO	NO
2.B.3	Adipic Acid Production									NO	NO		NO
2.B.4	Caprolactam, Glyoxal and Glyoxylic Acid Production									NO	NO		NO
2.B.5	Carbide Production	NO	NO	NO	NO	NO	NO		NO				
2.B.6	Titanium Dioxide Production	NO	NO	NO	NO								
2.B.7	Soda Ash Production	NO	NO	NO	NO								
2.B.8	Petrochemical and Carbon Black Production	NO	NO	NO	NO								
2.B.9	Fluorochemical Production												
2.B.10	Other (Please specify)												
2.C	Metal Industry												
2.C.1	Iron and Steel Production	NO	NO	NO	NO	NO	NO	NO	NO				
2.C.2	Ferroalloys Production	NO	NO	NO	NO								
2.C.3	Aluminium production	NO	NO	NO	NO	NO	NO	NO	NO				
2.C.4	Magnesium production	NO	NO	NO	NO								
2.C.5	Lead Production	NO	NO	NO	NO								
2.C.6	Zinc Production	NO	NO	NO	NO								
2.C.7	Other (please specify)												
2.D	Non-Energy Products from Fuels and Solvent Use												
2.D.1	Lubricant Use	T1	Industry and Customs Dept	IPCC	D								
2.D.2	Paraffin Wax Use	T1	Industry and Customs Dept	IPCC	D								
2.D.3	Solvent Use	NO	NO		NO								
2.D.4	Other (please specify)												
2.E	Electronics Industry												
2.E.1	Integrated Circuit or Semiconductor												
2.E.2	TFT Flat Panel Display												
2.E.3	Photovoltaics												
2.E.4	Heat Transfer Fluid												
2.E.5	Other (please specify)												
2.F	Product Uses as Substitutes for Ozone Depleting Substances	HFCs				PFC				SF_6			
2.F.1	Refrigeration and Air Conditioning	T1	Customs, NBS	IPCC	D	NE	NE	NE	NE	NE	NE	NE	NE
2.F.2	Foam Blowing Agents	NE	NE		NE	NE	NE	NE	NE	NE	NE	NE	NE
2.F.3	Fire Protection	T1	Customs, NBS	IPCC	D	NE	NE		NE				

Source and Sink Category		*Carbon dioxide (CO_2)*				*Methane (CH_4)*				*Nitrous oxide (N_2O)*			
		M	*AD*	*CF*	*EF*	*M*	*AD*	*CF*	*EF*	*M*	*AD*	*CF*	*EF*
2.F.4	Aerosols	NE	NE		NE	NE	NE		NE				
2.F.5	Solvents	NE	NE		NE	NE	NE		NE				
2.F.6	Other Applications (please specify)												
2.G	Other Product Manufacture and Use												
2.G.1	Electrical Equipment	NE	NE	NE	NE								
2.G.2	SF6 and PFCs from Other Product Uses					NE (PFCs)	NE		NE	NE (SF_6)	NE		NE
2.G.3	N_2O from Product Uses									NE (N_2O)	NE		NE
2.G.4	Other (Please specify)												
2.H	Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.H.1	Pulp and Paper Industry												
2.H.2	Food and Beverages Industry												
2.H.3	Other (please specify)												
3	Agriculture, Forestry, and Other Land Use												
3.A	Livestock												
3.A.1	Enteric Fermentation					T1	CSA	IPCC	D				
3.A.2	Manure Management					T1	CSA	IPCC	D	T1	CSA	CS	D
3.B	Land												
3.B.1	Forest land	T1	SGII	IPCC	D								
3.B.2	Cropland	T1	MoA	IPCC	D								
3.B.3	Grassland	NO	NO	NO	NO								
3.B.4	Wetlands	NE	NE	NE	NE								
3.B.5	Settlements	T1	SGII	IPCC	D								
3.B.6	Other Land	NO	NO	NO	NO								
3.C	Aggregate sources and non-CO_2 emissions sources on land												
3.C.1	Emissions from biomass burning	T1	CSA	IPCC	D								
3.C.2	Liming	T1	CSA	IPCC	D								
3.C.3	Urea application	T1	CSA	IPCC	D								
3.C.4	Direct N_2O Emissions from managed soils									T1	CSA	IPCC	D
3.C.5	Indirect N_2O Emissions from managed soils									T1	CSA	IPCC	D
3.C.6	Indirect N_2O Emissions from manure management									T1	CSA	IPCC	D
3.C.7	Rice cultivation					NO	NO	NO	NO				
3.C.8	Other (please specify)					NE	NE	NE	NE	NE	NE	NE	NE
3.D	Other												
3.D.1	Harvested Wood Products	NE	NE	NE	NE								
3.D.2	Other (please specify)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4	Waste												
4.A	Solid Waste Disposal					T1	CSA,						
4.B	Biological Treatment of Solid Waste					NE	NE	NE	NE	NE	NE	NE	NE
4.C	Incineration and Open Burning of Waste	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
4.D	Wastewater Treatment and Discharge					T1	CSA		D	T1	CSA		D
4.E	Other (please specify)												
5	Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5.A	Indirect N_2O emissions from the atmospheric deposition of nitrogen in NOx and NH3	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
5.B	Other (please specify)	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
	Memo Items (5)												
	International Bunkers												
1.A.3.a.i	International Aviation (International Bunkers)	T1	SEYPEC	D	D	T1	SEYPEC	D	D	T1	SEYPEC	D	D
1.A.3.d.i	International water-borne navigation (International bunkers)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
1.A.5.c	Multilateral Operations												

T1 = IPCC Tier 1 methodological approach; AD = Activity Data; CF = Conversion Factor; CSA EF = Emission Factor; D = IPCC Default; MoA = Ministry of Agriculture; NE = Not estimated; NO = Not occurring; NA: Not Applicable; SEYPEC = Seychelles Petroleum Company; SGII = Seychelles Geospatial Information Institute; National Statistical Bureau (NBS)

Table 2. 10: Methodological tiers used

1.	IPCC Category Description	2.	Method
•	1.A Fuel Combustion Activities	•	T1
•	1.A.1Energy Industries	•	T1
•	1.A.2Manufacturing Industries and Construction	•	T1
•	1.A.3Transport	•	T1
•	1.A.4 Other Sectors	•	T1
•	1.A.5 Non-Specified	•	T1
•	2.D.1 Lubricant Use	•	T1
•	2.D.2 Paraffin Wax Use	•	T1
•	2.F.1 Refrigeration and Air Conditioning	•	T1
•	2.F.3 Fire Protection	•	T1
•	3.A.1	•	T1
•	3.A.2	•	T1
•	3.B Land	•	T1
•	3.B.1 Forest land	•	T1
•	3.B.2 Cropland	•	T1
•	T13.B.5 Settlements	•	T1
•	3.C.1 Emissions from biomass burning	•	T1
•	3.C.2 Liming	•	T1
•	3.C.3 Urea application	•	T1
•	4.A Solid Waste Disposal	•	T1
•	4.D Waste water Treatment and Discharge	•	T1
•	1.A.3.a.i International Aviation (International Bunkers)	•	T1

Table 2. 11: List of all categories that are Not Estimated (NE) for all years

3.	IPCC Category Description	4.	Notation Key
•	*1.B Fugitive emissions from fuels*	•	NE
•	*1.B.1 Solid Fuels*	•	NE
•	*1.B.3 Other emissions from Energy Production*	•	NE
•	*2.F.2 Foam Blowing Agents*	•	NE
•	*2.F.4 Aerosols*	•	NE
•	*2.F.5 Solvents*	•	NE

3. IPCC Category Description	4. Notation Key
• *2.G.1 Electrical Equipment*	• NE
• *2.H Other*	• NE
• *3.B.4 Wetlands*	• NE
• *3.D.1 Harvested Wood Products*	• NE
• *3.D.2 Other (please specify)*	• NE
• *4.C Incineration and Open Burning of Waste*	• NE
• *5 Other*	• NE
• *5.A Indirect N_2O emissions from the atmospheric deposition of nitrogen in NOx and NH_3*	• NE
• *5.B Other (please specify)*	• NE

Table 2. 12: List of all categories that are Not Occurring (NO) for all years

5. **IPCC Category Description**	6. **Not Occurring**
• 1.B.2 Oil and Natural Gas	• NO
• 1.C Carbon dioxide Transport and Storage	• NO
• 1.C.1 Transport of CO_2	• NO
• 1.C.2 Injection and Storage	• NO
• 1.C.3 Other	• NO
• 2.A.1 Cement Production	• NO
• 2.A.2 Lime Production	• NO
• 2.A.3 Glass Production	• NO
• 2.A.4 Other Process Uses of Carbonates	• NO
• 2.A.5 Other (please specify)	• NO
• 2.B Chemical Industry	• NO
• 2.B.5 Carbide Production	• NO
• 2.B.6 Titanium Dioxide Production	• NO
• 2.B.7 Soda Ash Production	• NO
• 2.B.8 Petrochemical and Carbon Black Production	• NO
• 2.C.1 Iron and Steel Production	• NO
• 2.C.2 Ferroalloys Production	• NO
• 2.C.3 Aluminium Production	• NO
• 2.C.4 Magnesium Production	• NO
• 2.C.5 Lead Production	• NO
• 2.C.6 Zinc Production	• NO
• 2.D.3 Solvent Use	• NO
• 3.B.3 Grassland	• NO
• 3.B.6 Other Land	• NO
• 1.A.3.d.i International water-borne navigation (International bunkers)	• NO

5. IPCC Category Description	6. Not Occurring
•	• NO

2.8 Improvements

The Improvement Plan is a list of the identified actions required for GHG inventory improvements (Table 2-13). For each action, a description of the improvement is provided, and the specific weakness is identified, e.g., data source. The actions are then prioritized and allocated to a responsible organization. The progress in implementing the actions is tracked through the Improvement Plan. The Improvement Plan is maintained by the QA/QC coordinator with input from the sector leads. The Improvement Plan is reviewed and updated at the start and end of each inventory cycle. The table below provides an overview of planned improvements to the national GHG inventory system, data- sets, and processes. This list was compiled by the GHG inventory sector experts GHG inventory sector experts compiled this list, and it identifies the actions needed to reduce uncertainties and improve the overall quality of the inventory.

Table 2. 13: Improvements plan

Category	Sub-category	Name of improvement	Description of improvement
1. Energy	1A3a Aviation	Fuel use consumption data for aviation	Collect disaggregated data for aviation fuel consumption to show data used in other domestic aviation and international aviation.
1. Energy	1A3b Road Transport	Vehicle data	Collect actual data on the actual number of each type of vehicle that is on the road for each year (the current motor registry contains scrapped/sold vehicles, and scrappage rates have been estimated).
2. IPPU	2D1 Lubricant Use	Activity data - the amount of lubricant consumed	AThe amount of lubricant consumed is not available for this compilation and could be improved by accessing import data.
2. IPPU	2D3 Domestic solvent use	Population - Activity data	The emission factor value per capita was obtained from EMEP/EEA Guidebook 2019. This is not a critical category, but actual data can improve the accuracy of emissions from this sector. A method of getting country-specific data for future inventories needs to be developed, and data from ERA could be verified.

Category	Sub-category	Name of improvement	Description of improvement
2. IPPU	2D4 Road paving with asphalt	Length of road paved -Activity data	The data for the years after the last inventory have been extrapolated. Even though this is not a critical category, accurate data on the length of paved roads are essential and the amount of asphalt used is an available data set.
2. IPPU	2F1 Refrigeration and air conditioning	Amount of F-gases imported and used - activity data	The data from this category were obtained from an inventory done under the Montreal Protocol. These data covered only 20 years, and assumptions on historical data were made to estimate data from previous and forward years after the 4-year inventory. There is need to improve the data collection in future inventories. Country-specific data can be generated by doing local studies, especially on the lifespan of refrigerators and air-conditioners as this has a bearing on when the reported emissions occurred.
2. IPPU	2F1 Refrigeration and air conditioning	Activity data - F-gases	Split out data by sub-category (e.g. domestic refrigeration) so that specific factors can be applied (e.g. lifetime of domestic fridges is different to lifetime of industrial fridges)
2. IPPU	2H2 Food and Drink	Production data - Activity data	These data can be improved by verifying data and developing a data collection strategy for all the foods and drinks in this category.
3. AFOLU	3C4 Direct N_2O emissions from managed soils	Activity data - crop residue management This includes specific crop data and fallow croplands to move to a higher tier calculation for croplands	There is a lack of country specific information on crop residue management for different crop types.
3. AFOLU	3A1 Enteric fermentation	Emission factor data - enteric fermentation for livestock categories	Currently IPCC default emission factors are applied. It is therefore recommended that there be studies to determine country specific enteric fermentation emission factors.
3. AFOLU	3C2 Lime application	Activity data - Improve data collection and reporting on the application of lime in agricultural areas /farms of the country Acivty data: Improvement in the recording of lime application and records keeping of import records for lime.	There are only a few data points as lime data are not consistently collected. It is therefore important to collect lime consumption data for this category. There is no consistent records keeping of import records for lime

Category	Sub-category	Name of improvement	Description of improvement
3. AFOLU	3A Livestock	Activity data - livestock population	Livestock data are not reported consistently on an annual basis so the annual reporting needs to be improved and the livestock classifications must remain consistent. It is recommended that population data be collected annually. Develop a system to collect livestock population data by farm types(commercial farms and small scale)
3. AFOLU	3A2 Manure management	Activity data - manure management	There is a lack of country specific data on manure management systems, therefore it is recommended that that data be collected on how the manure for various livestock is managed and to develop a tool and platform for data collection on national manure management
3. AFOLU	3A2 Manure management	Emission factor data - manure management	There is a lack of country-specific emission factors for manure management as IPCC default, hence regional factors are applied. It is recommended to carry out studies to determine country specific manure management emission factors.
3. AFOLU	3C3 Urea application	Activity data - urea consumption	Urea import data are very erratic and are not consistent across the time series. Improved urea import data are required to improve estimates for this category.
3. AFOLU	3B - Cropland	Improved cropland production and management data	Inclusion of specific crop data and fallow croplands to move to a higher tier calculation for croplands.
3. AFOLU	3B - Land	Improved land use mapping	Inconsistent time series and variable data on land use. Some categories such as wetlands/flooded land and other land are not well mapped. There is need to undertake an improved land cover/land use classification for the period 1990 – 2020, at the least at 5-year intervals through remote sensing data with ground proofing .
3. AFOLU	3B1 - Forest land	Refined natural plantations data with cadastral and species data Disaggregate forest data by forest type to natural and plantation forests	Provide detailed and species-specific data for natural plantation forests. Diaggrenated forest data by forest type, including Introduction of age class data in plantations and natural forests

Category	Sub-category	Name of improvement	Description of improvement
3. AFOLU	3B4aii – Wetlands flooded land 3C4. Biomass burning	Wetland mapping Biomass Burning data by land use type	There is currently no national time series data on natural wetlands. A national wetland mapping exercise coupled with remote sensing should be undertaken to develop a time series from 1990 to present. Collect data and establish a methodology for estimating emissions from biomass burning across all land uses.
4. Waste	4D Wastewater treatment and discharge - Improve Activity data	Activity data – Wastewater generation and treatment pathways data, country specific chemical oxygen demand (COD) and biological oxygen demand (BOD) data and national all-inclusive waste-water protein content data	Collection of Waste-water generation and treatment including , waste-water COD and BOD data and a national all-inclusive waste-water protein content data.
4. Waste	4A Solid Waste Disposal - Improve Quality of Activity Data	Activity data – Country specific parameters to be used in the IPCC Waste Model	Country specific data for waste generated per capita, national specific waste, specific composition (including data on industrial waste) Conduct a national waste survey to determine the quantities of waste generated, composition and waste streams
4. Waste	4A Solid Waste Disposal – Improve Quality of Activity Data	Activity data – Total Quantity of Waste produced in the country Activity data- Collection of data was difficult due to lack of system for collecting, transmitting waste data	Data on amount of total waste produced in the country and the proportion of waste disposed of in Solid Waste Disposal Sites (SWDS) are not available. Set up waste sector activity data collection templates and transmission system

2.9 Trends

2.9.1 Total GHG emissions by sector

This section illustrates Seychelles' GHG emissions from all sectors between 2000 and 2020. The tables and charts below present the total GHG emissions by sector and by gases. The subsections below explore the GHG emissions and trends in each sector in more detail.

Seychelles' GHG emissions in 2020 are estimated at 558.60 Gg CO2e, where 77 % of emissions came from the Energy sector; the AFOLU sector contributed 13%, the Waste sector contributed

8% of emissions, and IPPU contributed 2 % (Figure 2-3). Seychelles' total GHG emissions have steadily risen since 2000 (Figure 2-4), primarily driven by increasing emissions from the Energy sector. The main leading causes for increasing emissions in this sector stem from electricity power generation and the road transportation sub-sectors. The second most significant sector is the AFOLU Sectorfor which emissions also increased over the whole time series due to increased clearing of forest areas for infrastructure de, for which emissions also increased over the entire time series due to increased clearing of forest areas for infrastructure development. Overall, the total GHG emissions show an increasing trend across the time series at 272.83 Gg CO2e in 2000 and 558.60 Gg CO2e in 2020; this constituted a 51.16 % increase in 2020.

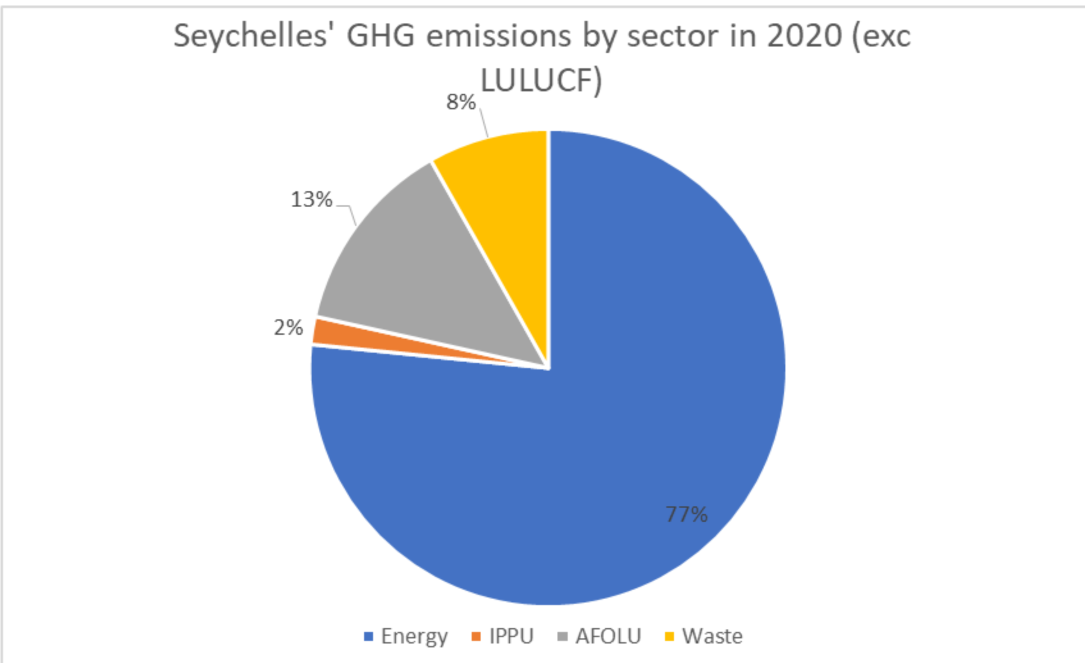


Figure 2-3: Seychelles' GHG emissions by sector in 2020

2.9.2 Total GHG Emissions and Removals by sector

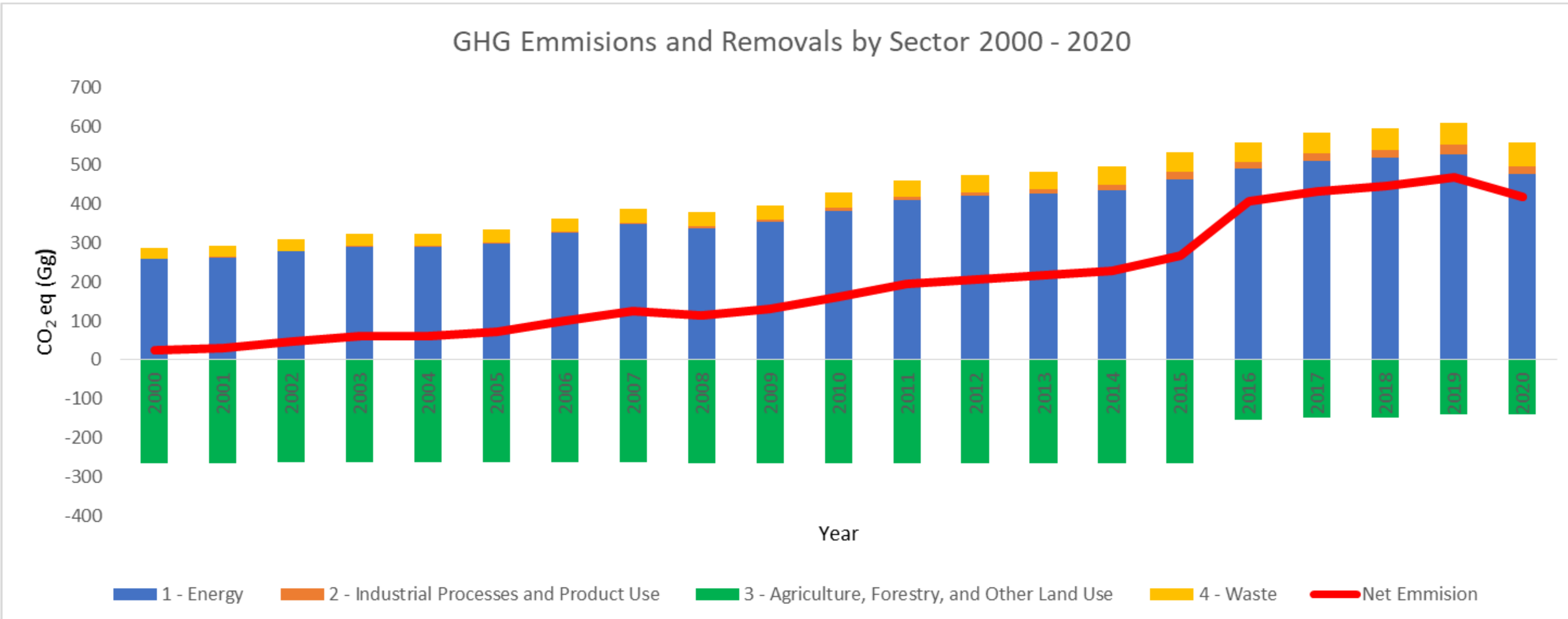


Figure 2-4: Seychelles'' Total GHG Emissions and Removals by sector 2000 – 2020

Table 2. 14: Seychelles' GHG emissions by sector for key years between 2000-2020

Year	2000	2005	2010	2015	2016	2017	2018	2020	Change between 2000 and 2020	Percentage contribution of total change
Sector	*Gg CO_2e*									
1. Energy	***259.39***	298.77	383.59	463.22	490.97	510.24	518.46	467.04	168.27	99.87%
1.A - Fuel Combustion Activities	259.39	298.77	383.59	463.22	490.97	510.24	518.46	467.04	168.27	99.87%
1.A.1 - Energy Industries	137.06	164.68	211.83	254.31	273.98	281.29	286.12	299.96	149.06	108.76%
1.A.2 - Manufacturing Industries and Construction	13.78	13.69	14.66	17.49	18.50	18.76	16.89	14.13	3.12	22.61%
1.A.3 - Transport	68.26	82.03	104.76	126.78	133.12	143.88	147.83	114.00	79.57	116.57%
1.A.4 - Other Sectors	41.56	39.91	54.31	67.01	67.90	68.98	70.32	47.77	28.76	69.18%
1.A.5 - Non-Specified	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1.B - Fugitive emissions from fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1.B.1 - Solid Fuels	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1.B.2 - Oil and Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
1.B.3 - Other Emissions from Energy Production	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
2 - Industrial Processes and Product Use	0.74	3.10	7.54	19.79	16.23	19.18	21.69	22.09	18.99	2833.15%
2.D - Non-Energy Products from Fuels and Solvent Use	0.38	1.01	3.68	3.01	0.76	1.05	1.38	1.38	0.36	262.83%
2.D.1 - Lubricant Use	0.38	0.993	3.489	3.008	0.757	1.040	1.373	1.37	0.38	264.28%
2.D.2 - Paraffin Wax Use	0.00	0.02	0.19	0.00	0.01	0.01	0.01	0.01	0.01	128.80%
2.D.3 - Solvent Use										
2.D.4 - Other (please specify)										
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.36	2.09	3.86	16.78	15.47	18.13	20.30	20.71	20.35	5567.57%
2.F.1 - Refrigeration and Air Conditioning	0.27	1.61	2.97	12.56	11.55	13.20	14.38	14.36	13.83	5137.02%
2.F.2 - Foam Blowing Agents										
2.F.3 - Fire Protection	0.08	0.48	0.89	4.22	3.92	4.93	5.92	6.35	6.27	6980.65%
2.F.4 - Aerosols										
2.F.5 - Solvents										
2.F.6 - Other Applications (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

Year	2000	2005	2010	2015	2016	2017	2018	2020	Change between 2000 and 2020	Percentage contribution of total change
2.H.1 - Pulp and Paper Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
2.H.2 - Food and Beverages Industry	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
2.H.3 - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3 - Agriculture, Forestry, and Other Land Use	-264.08	-263.47	-266.31	-265.07	-152.38	-148.58	-147.09	-147.63	116.45	-44.30%
3.A - Livestock	2.68	2.54	1.55	1.56	1.57	1.53	1.47	4.13	1.45	-45.09%
3.A.1 - Enteric Fermentation	0.33	0.30	0.16	0.19	0.19	0.18	0.17	0.29	-0.04	-48.32%
3.A.2 - Manure Management	2.35	2.24	1.39	1.37	1.39	1.35	1.30	3.84	1.49	-44.64%
3.B - Land	-278.93	-277.04	-275.14	-273.24	-160.52	-156.84	-155.01	-151.34	127.59	-44.43%
3.B.1 - Forest land	-308.36	-306.46	-304.57	-302.67	-302.67	-299.00	-297.17	-293.50	14.86	-3.63%
3.B.2 - Cropland	2.19	2.19	2.19	2.19	14.67	14.67	14.67	14.67	12.47	568.67%
3.B.3 - Grassland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3.B.4 - Wetlands	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3.B.5 - Settlements	27.23	27.23	27.23	27.23	127.49	127.49	127.49	127.49	100.25	368.11%
0.29 3.B.6 - Other Land	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3.C3.84 - Aggregate sources and non-CO_2 emissions sources on land	12.17	11.03	7.28	6.61	6.57	6.74	6.44	6.58	-4.45	47.07%
3.C.1 - Burning	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3.C.2 - Liming	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.00	0.00%
3.C.3 - Urea application	0.00	0.01	0.02	0.01	0.00	0.02	0.00	0.00	0.00	-99.94%
3.C.4 - Direct N_2O Emissions from managed soils	10.35	9.17	5.97	5.27	5.20	5.42	5.16	6.01	-3.16	50.18%
3.C.5 - Indirect N_2O Emissions from managed soils	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3.C.6 - Indirect N_2O Emissions from manure management	1.34	1.37	0.81	0.86	0.88	0.83	0.81	0.08	-1.26	-39.65%
3.C.7 - Rice cultivation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3.C.14 - Other (please specify)										
4 - Waste	28.66	32.88	37.50	49.60	51.93	52.86	54.73	60.47	31.81	2320.28%
4.A - Solid Waste Disposal	26.82	31.00	35.69	47.48	49.79	50.68	52.54	58.23	31.41	
4.B - Biological Treatment of Solid Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
4.C - Incineration and Open Burning of Waste	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		

Year	2000	2005	2010	2015	2016	2017	2018	2020	Change between 2000 and 2020	Percentage contribution of total change
4.D - Wastewater Treatment and Discharge	1.84	1.88	1.81	2.12	2.15	2.19	2.19	2.23	0.39	
4.E - Other (please specify)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Grand Total (with AFOLU)	***305.72***	***359.51***	***449.51***	***553.44***	***694.83***	***717.92***	***729.78***	***697.23***	***325.52***	**138.70%**

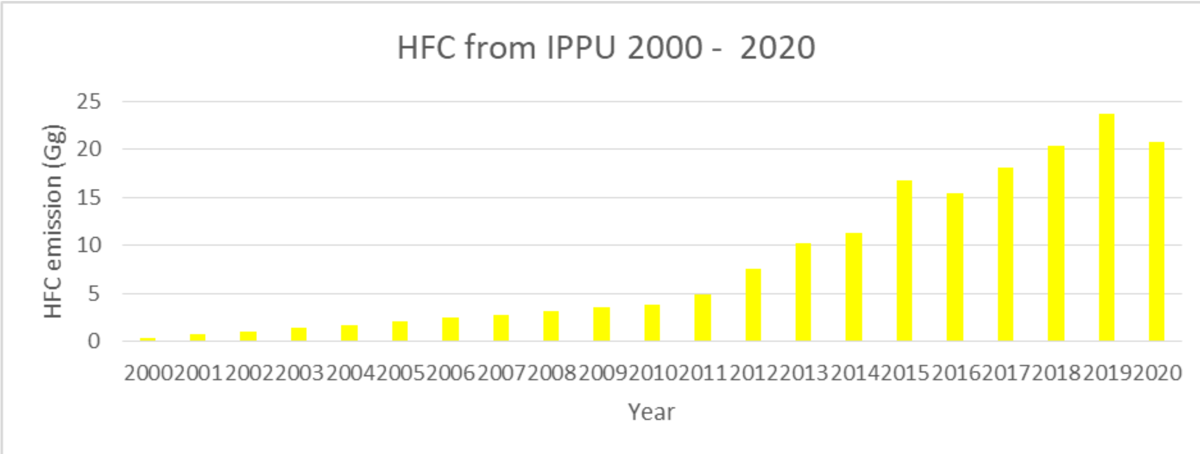


Figure 2-5: HFC emissions from IPPU

2.9.3 Total emissions from International bunker fuels

Emissions from international bunker fuels were generally stable over the whole time series, showing gradual increases from 2005 to 2009 and from 2015 to 2019 periods, with a decrease in 2020 due to the impact of COVID, with a reduction in 2020 due to the effects of COVID-19 (Figure 2-6). The highest emissions in Seychelles were recorded in 2017 at above 700 Gg CO2eq. Interestingly, the year 2004 had the lowest emissions, which were around 500 Gg CO2eq. The trends are driven by the general consumption of fuel in aviation.

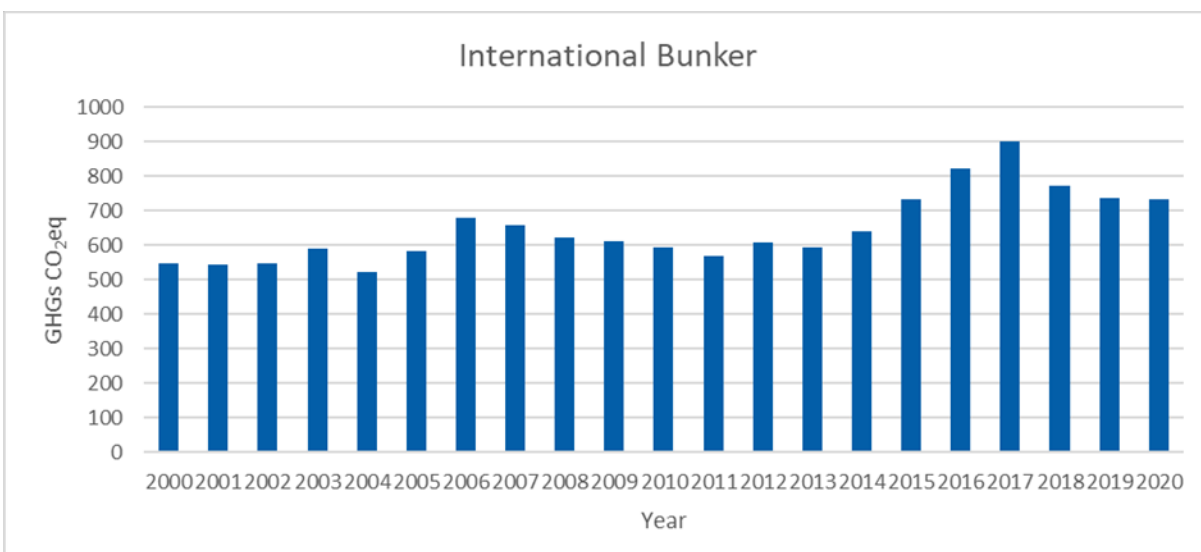


Figure 2-6: Total emissions from International bunker fuels

2.10 Total GHG emissions by gas

Seychelles' net GHG emissions across the time series 2000-2020 are dominated by CO2 releases (83.4%), followed by CH4 (10.77%), N2O (1.28%) and F-gases (4.49%) with 2.5% CO2 removals. Since 2000, CO2 has been the most important GHG in Seychelles in terms of its contribution to the national total, principally originating in the energy sector (Figure 2-7). Methane emissions were dominated by the waste sector. The waste sector dominated methane emissions and showed an increasing trend between 2000 and 2020, although there was a decrease in N_2O across the time series. This changing dynamic was primarily due to the decreasing influence of the agricultural sector in Seychelles, which was attributed to the reduced application of fertilizers on soils. The release of F-gases has steadily increased due to the use of air conditioning since 2000, but their relative share of total GHG emissions has remained small.

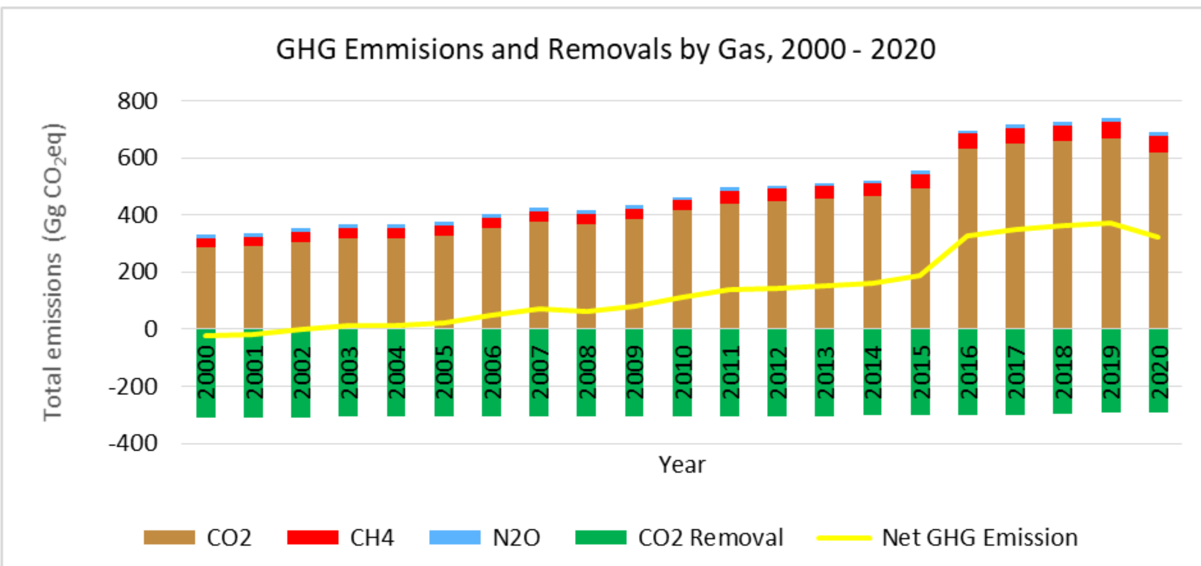


Figure 2-7: Seychelles' 2000 - 2020 GHG emissions by gas

The sub-sections below show emissions by of gas contributed by each sector (2.2a to 2.2e).

2.10.1 Carbon dioxide Emissions- CO2

CO2 emissions dominated GHG emissions from 2000 to 2020, contributing an average of above 83% of total emissions from 2000 to 2020 (Figure 2-8). The energy sector was the primary source of CO2 over the time series, with an almost consistent and uniform rise. Emissions from IPPU and AFOLU were almost practically insignificant, accounting for less than 3% of the total emissions

(Figure 16). On the other hand, within the AFOLU sector, the LULUCF sub-sector was a declining sink of CO2 removals over the time series. From 2016, a sharp decline in CO_2 removals in Seychelles correlates with increased CO_2 emissions over the same period.

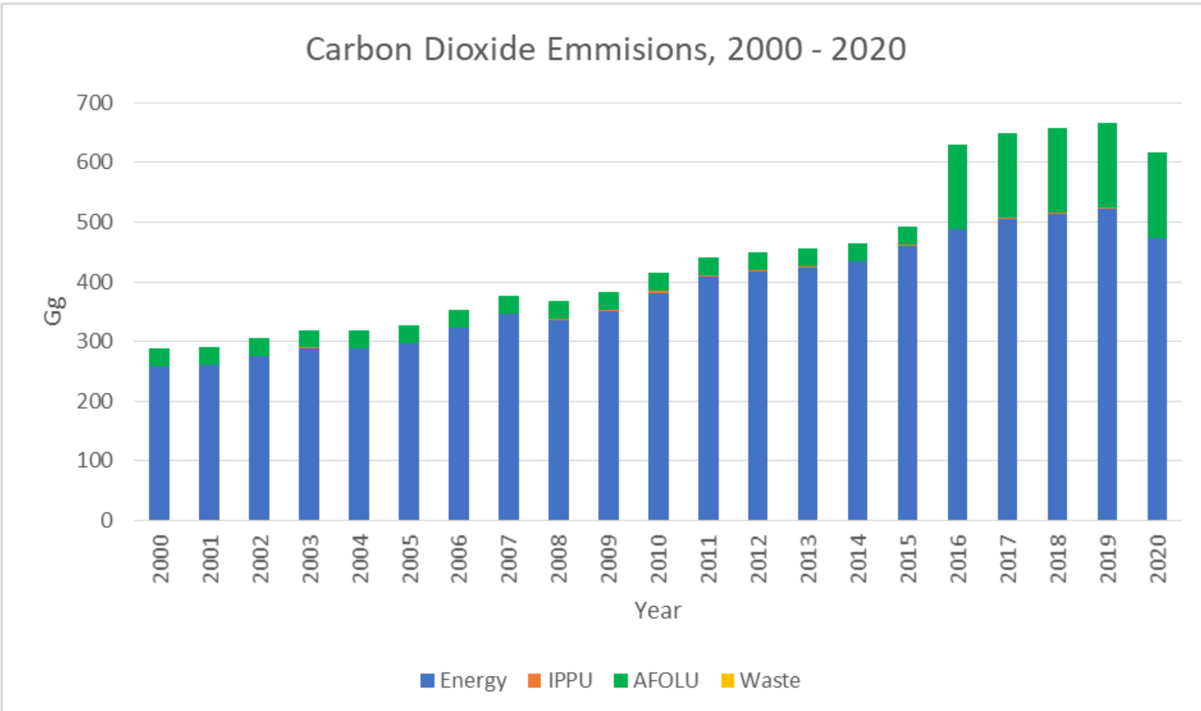


Figure 2-8: Seychelles' CO2 Emissions 2000-2020

2.10.2 Methane emissions- CH_4

The waste sector was the primary source of CH4 across the time series, showing a sharp increase from 2000 to 2020 (Figure 2-9). CH_4 emissions from the AFOLU sector were the second largest source and remained relatively constant across the time series. The Energy sector had the most negligible CH4 emissions over the time series.

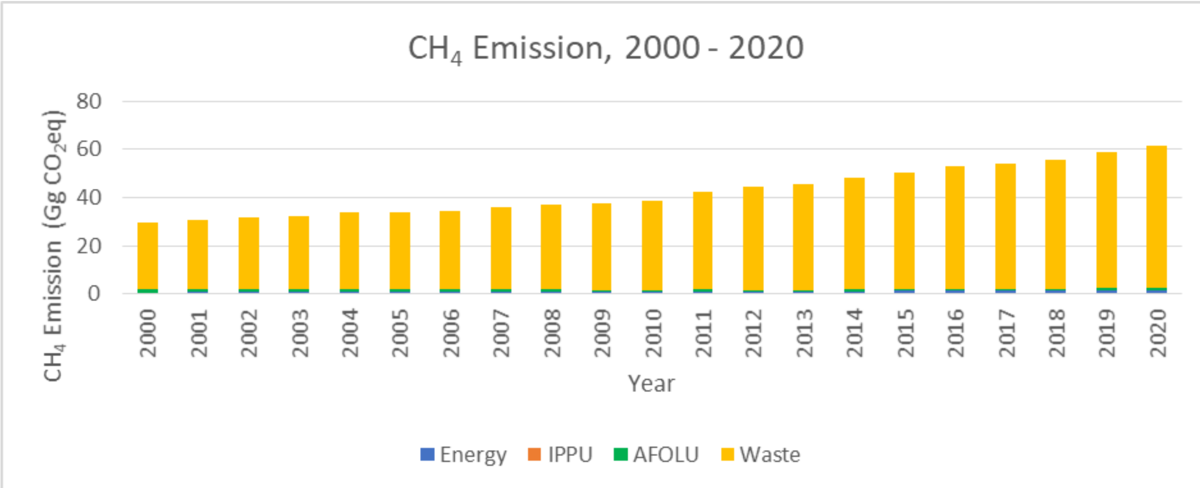


Figure 2-9: CH4 Emissions

2.10.3 Nitrous Oxide Emissions- N2O

The energy, AFOLU, and waste sectors were the only sectors that recorded N_2O emissions, with the energy sector producing almost two-thirds of the total N_2O emissions over the whole time series. The N_{2O} emissions from the energy sector showed a gradually increasing trend from 2000 to 2018 and a slight increase in 2019 (Figure 2-10). Emissions from the Waste Sector showed a small contribution to the trend across the whole time series.

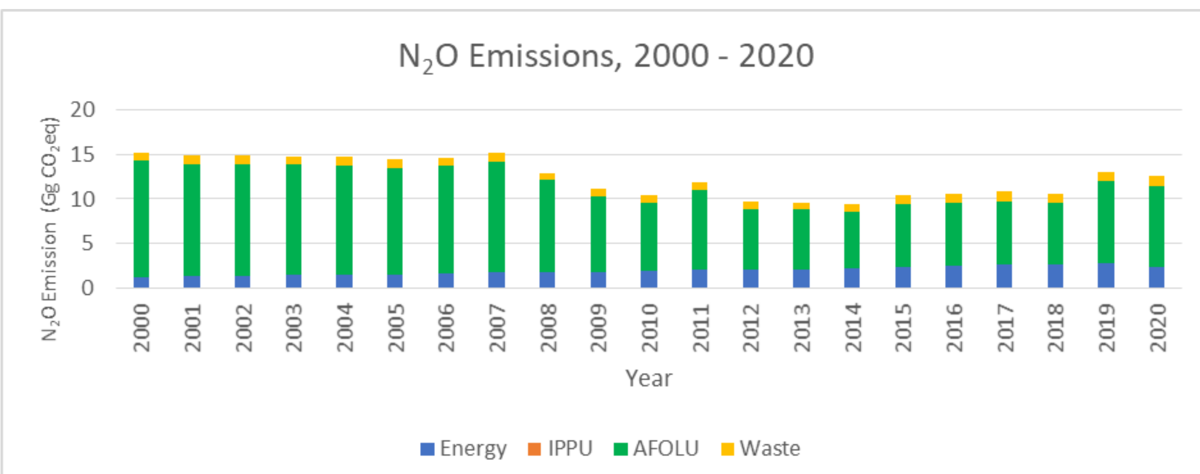


Figure 2-10: N2O Emissions

2.10.4 HFCs

HFCs were only reported for the Refrigeration and Air Conditioning (2.F.1) and Fire Protection (2.F.3) categories under the IPPU Sector (Figure 2-11). The emissions showed a steep rise from 2011 to 2020. Emissions showed a gradual increase between 2000 and 2011. This was followed by a spike from 2012 to 2019, despite a slight drop in 2016 emissions. The spike was related to increased national use of HFCs in air conditioning and refrigeration.

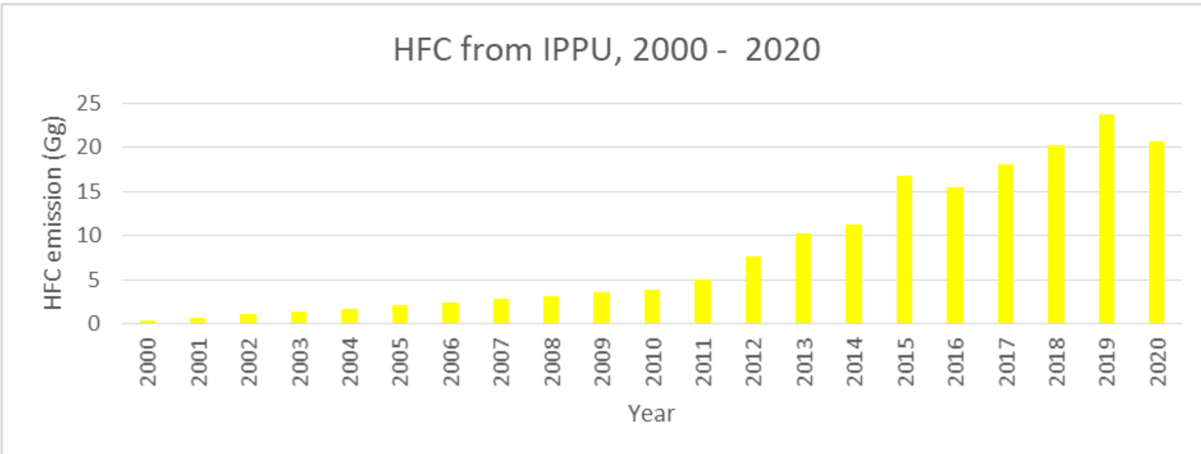


Figure 2-11: HFCs emissions from the IPPU Sector

2.11 Energy

The total emissions from the Energy sector, in Gg CO2e, are shown in Figure 20, split by gas, and in Figure 2-12 split by IPCC category. The dominating GHG in the energy sector is carbon dioxide, methane, and nitrous oxide. There has been a steady rise in CO_2 emissions from fossil fuel combustion in thermal power stations.

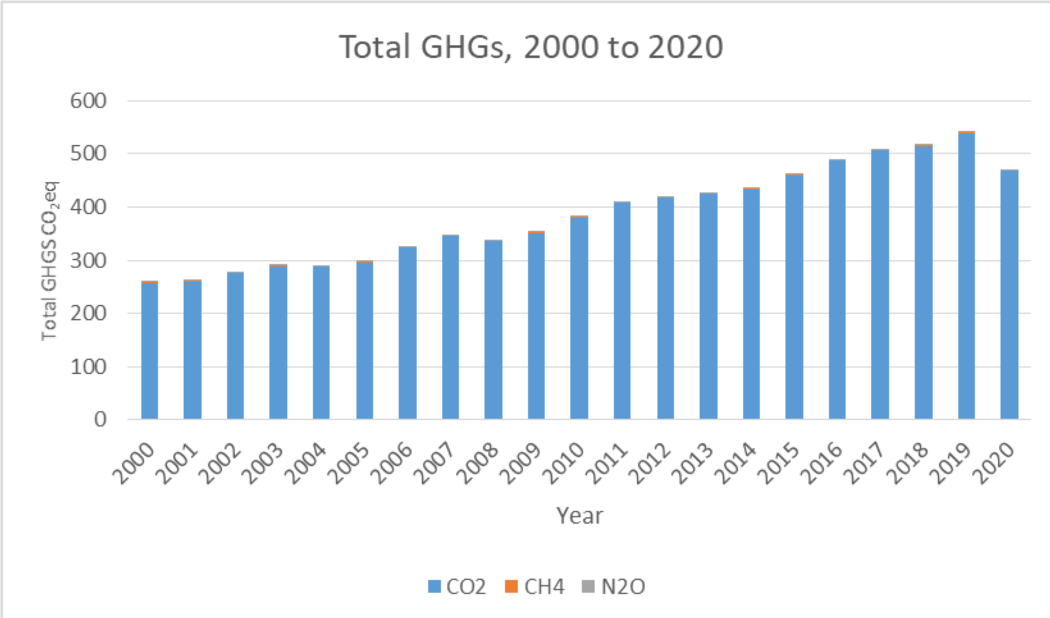


Figure 2-12: Energy Sector Emissions by Gas

The largest source categories in the Energy sector are 1A1 (energy industries), accounting for an average of 63% of the total GHG emissions from the energy sector, followed by transport (1A3b), contributing an average of 24%, and 1A4 (residential and commercial) with 10% (Figure 2-13). Manufacturing Industries and Construction (1A2) contributed the most negligible emissions, amounting to less than 3% of Seychelles' emissions from the energy sector. There was a steady increase in GHG emissions for the whole time series, with emissions rising from 259.39 Gg CO2eq in 2000 to 543 Gg CO2eq in 2019 owing to increased consumption of fossil fuels and a slight decrease to 472 Gg CO2eq owing to Covid -19 pandemic in 2020.

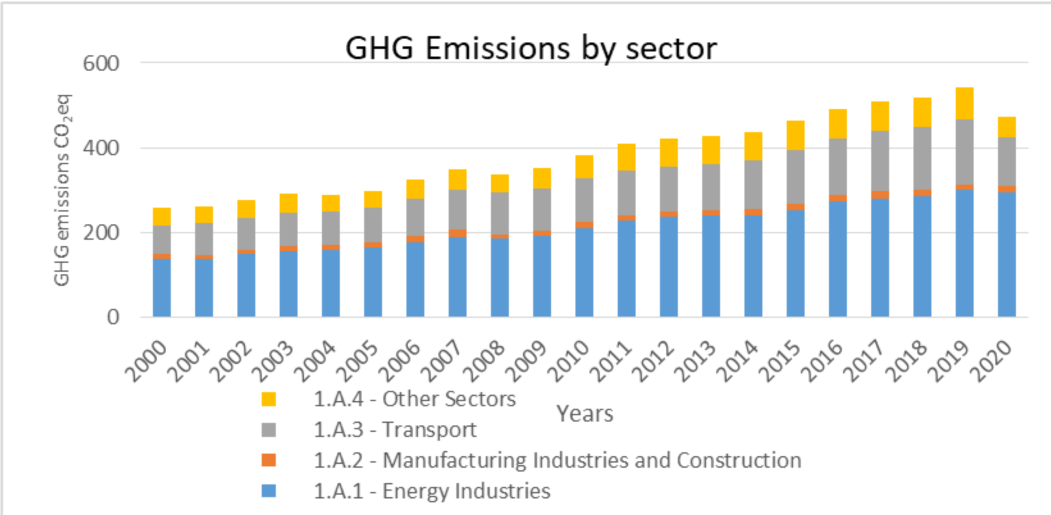


Figure 2-13: Energy Sector Emissions by Category

There were no significant fluctuations in emissions across the energy sector sub-categories. The steady increase in GHG emissions was attributed to the corresponding increase in the use of fossil fuels in power generation, transport, residential, and commercial sectors.

IPPU

Overall, GHG emissions from the IPPU sector have sharply risen since 2011, primarily due to an increasing quantity of imported F-gases used for refrigeration and air conditioning. However, there has been a steady decline in CO2 emissions, albeit in a fluctuating trend (Figure 2-14).

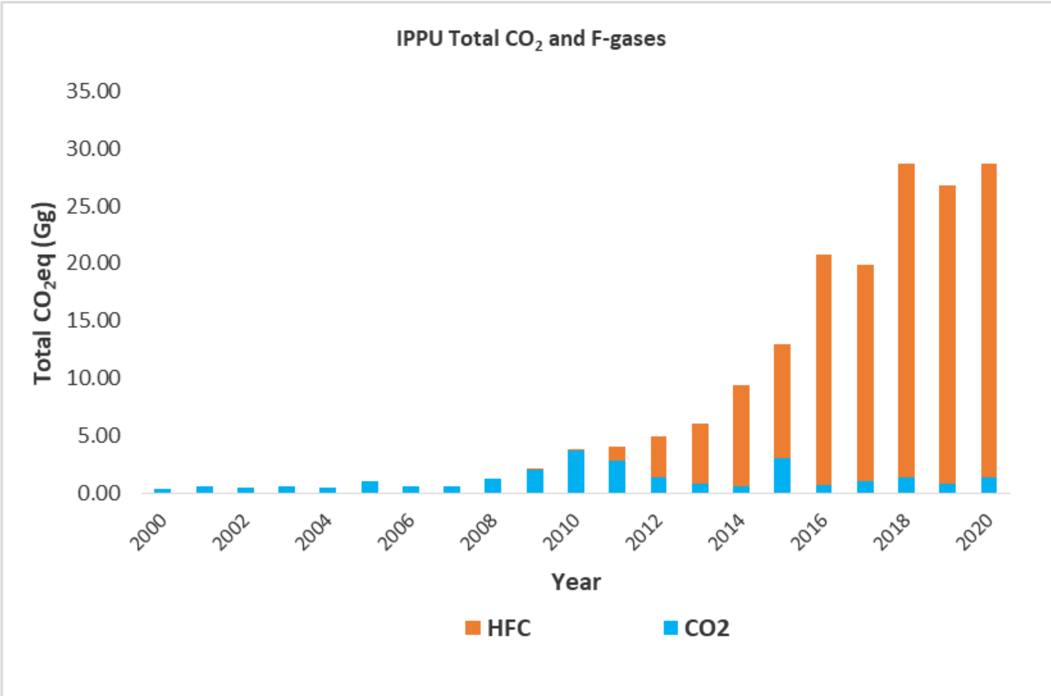


Figure 2-14: IPPU Sector Emissions by Gas

The steady increase in Gross Domestic Product (GDP) from 2000 saw an increase in GHG emissions from the IPPU sector, owing to a significant rise in HFCs emissions. A major increase in the hotel establishments and the service sector led to the increasing trend in the refrigeration and air-conditioning (RAC) sector since 2011 (Figure 2-15).

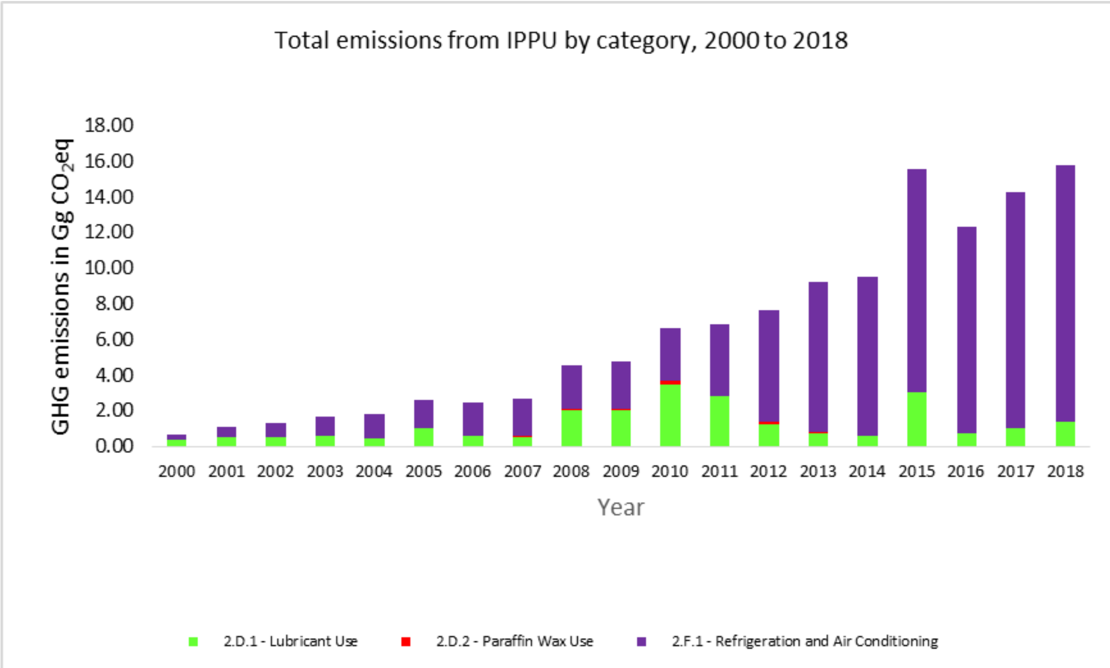


Figure 2-15: IPPU Sector Emissions by Category

2.12 AFOLU

Overall, the AFOLU sector was a decreasing net sink from 2000 at -264.08 Gg CO2e and -147.21 Gg CO2e in 2020. The emissions trend was driven mainly by emissions from land conversion from Forest land to Settlements under the 3B Category. A key driver of this change was the land and housing policy, which aimed to guarantee that every Seychellois family had a decent house. Other housing programs, such as the 24 houses in 24 months in 24 districts initiated by the former government administration in 2017, also contributed to this result. There was a gradual downward trend under the 3C categories: aggregated sources and non-CO2 emission sources from land at 12.2 Gg CO2e in 2000 to 9.11 Gg CO2e in 2020.

This trend was driven primarily by changes in policy in the agricultural sector that led to a decrease in the area of cultivated agricultural land as well as a decrease in livestock population as a result of increased food importation (meats and vegetables) driven by policies such as the Strategy 2012 – 2017, which hindered the development of commercial agriculture in favor of the tourism and infrastructure sectors. The AFOLU Sector, including the LULUCF, represents a net emission source in 2020 compared to 2000. However, the AFOLU Sector, excluding the LULUCF, showed a downward trend from 2000 to 2020. This did not suggest that the agricultural sector of Seychelles was not a significant contributor to emissions but rather showed that the sector had reduced emissions from 14.9 Gg CO2e in 2000 to 7.9 Gg CO2e in 2020. This indicated that overall, the AFOLU sector decreased its emission by 10.85% (1.61 Gg CO2e) or an annual decrease in emissions of 0.089 Gg CO2e or 0.6% (Figure 2-16).

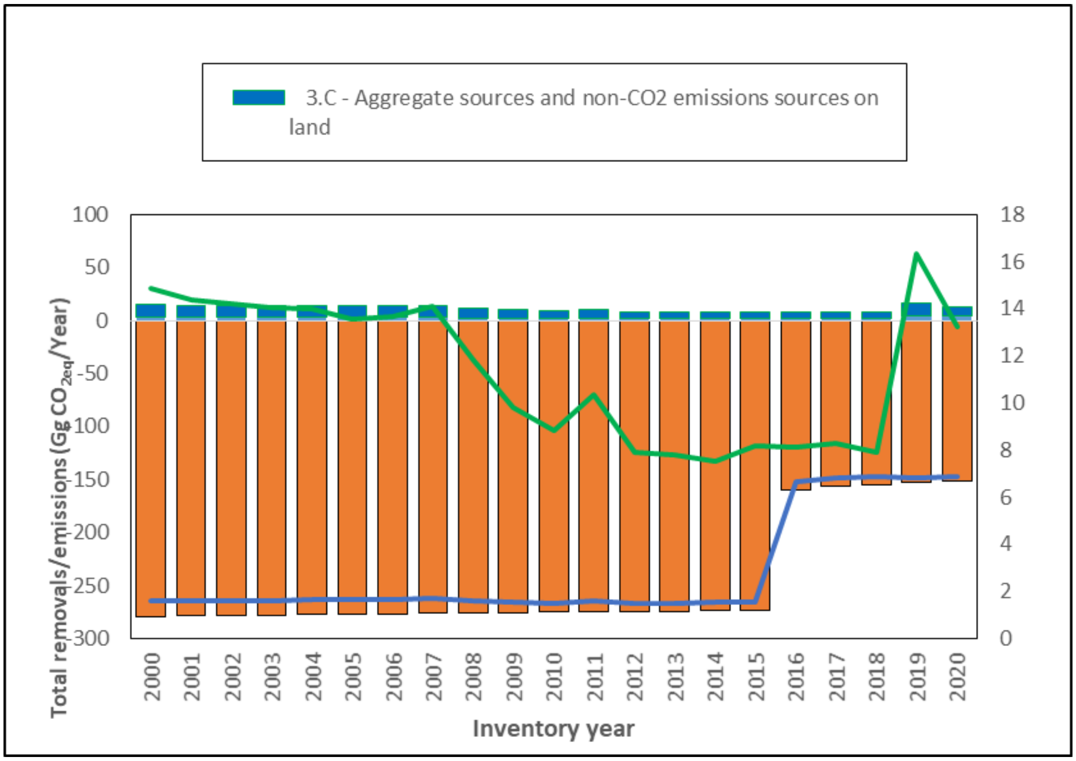


Figure 2-16: Trends in emissions and removals for the AFOLU sector in Seychelles between 2000 and 2020

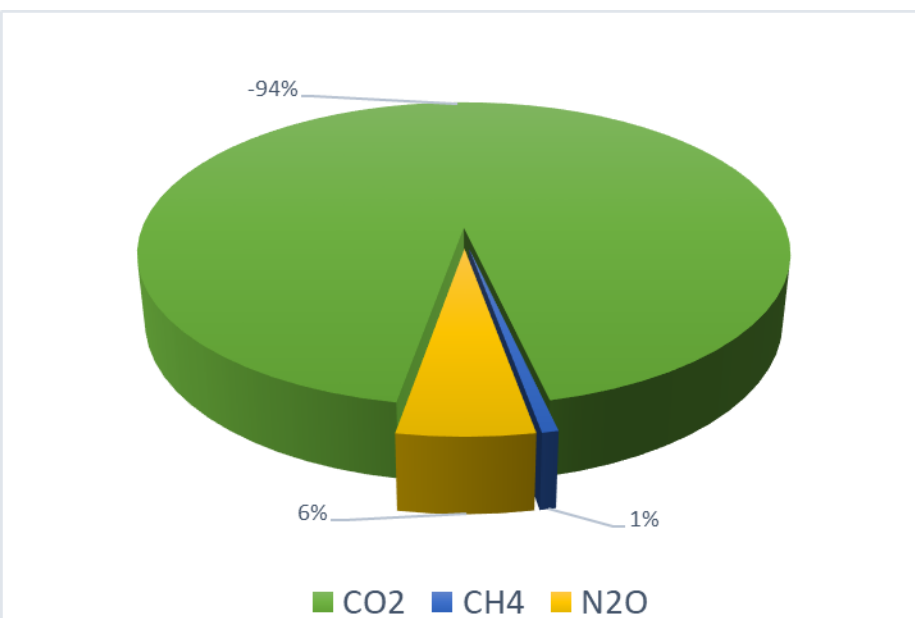


Figure 2-17: Seychelles' AFOLU Sector emissions by Gas Summary of percent contribution by gas in 2020

Within the AFOLU sector, forest land had the most significant contribution at -65.8%, representing a net removal of CO_2 (Figure 2-18). This was followed by emissions from settlements at 28.6%, cropland at 3.3%, emissions from soils, and direct N2O from the managed soils category at 1.2%, followed by manure management at 0.3% (Figure 2-19). The remaining sources shared the rest, including indirect N2O-managed soils, Urea application, enteric fermentation, and Liming (See Figure 2-20).

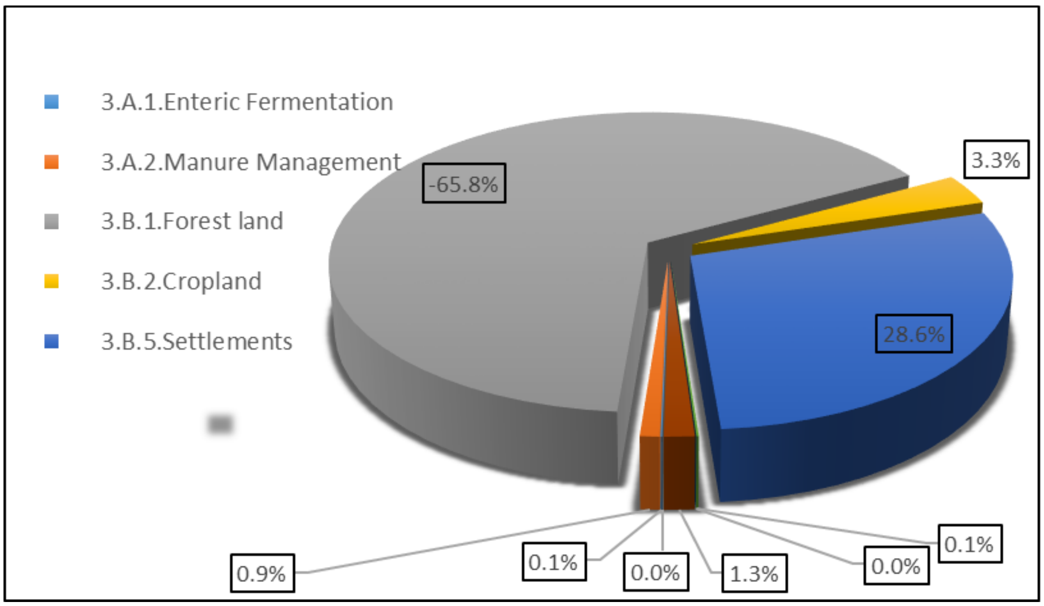


Figure 2-18: AFOLU Sector emissions by Category 2020

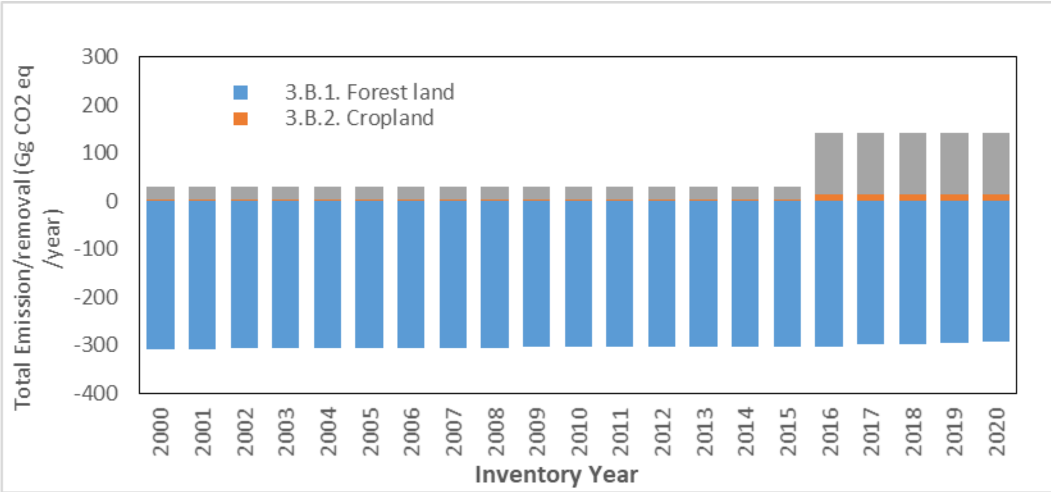


Figure 2-19: Net CO2 emissions and removals (Gg CO2e per year) from the Land category by land-use type from 2000 to 2020

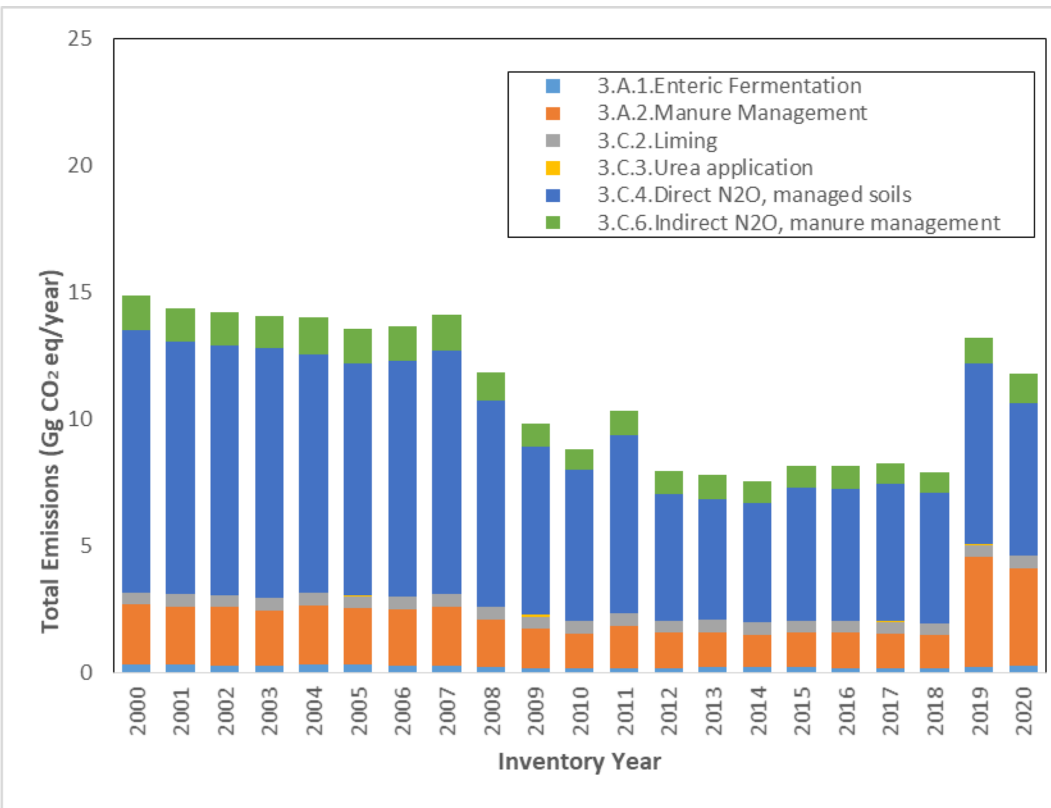


Figure 2-20: Emissions trends from the Seychelles' agricultural components of the AFOLU sector from 2000 to 2020

2.13 Waste

GHG emissions from the waste sector have risen from 28.66 Gg CO2eq in 2000 to 60.47 GgCO2eq in 2020 (Figure 2-21). Solid waste disposal (4D) by landfilling has been the primary source of emissions over the whole time series, accounting for 95% of the emissions from 2000 to 2020. Domestic wastewater treatment and discharge (4D) contributed to low emissions, i.e., 5%. The growth in GHG emissions is related to the rising population and imports.

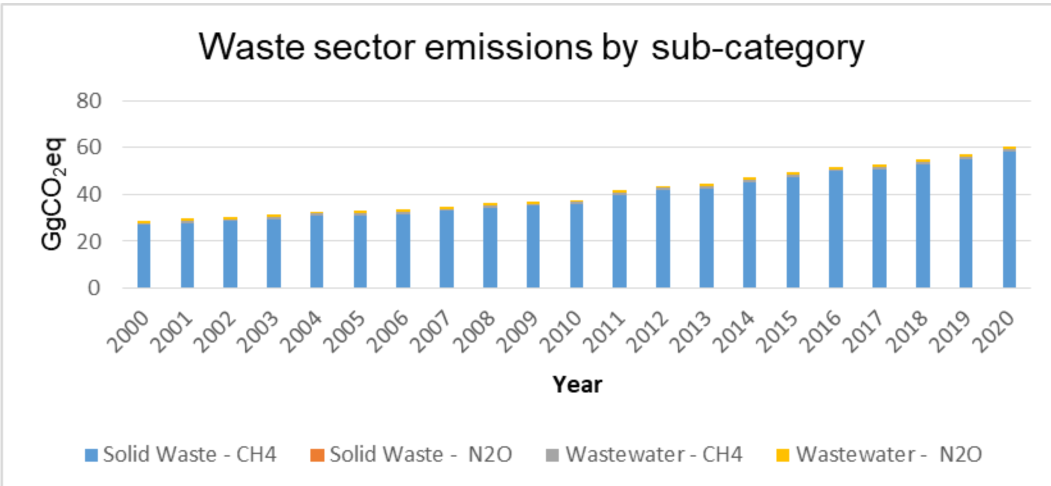


Figure 2-21: Waste sector emissions by sub-category, 2020-2020

The solid waste disposal emission trends have gradually increased over the years due to the increased national population. An increase in the population is likely the plausible reason for the trend seen in wastewater treatment. All the waste management practices and population distribution characteristics were assumed to be constant across the time series. This resulted in the population trend defining the Waste sector emissions trend.

In 2020, 60.467 Gg CO2eq emissions were emitted from the waste sector in Seychelles. Most of the emissions were from solid waste disposal (4A), contributing 96%, with domestic wastewater treatment and discharge (4D) accounting for 4% (Figure 2-22).

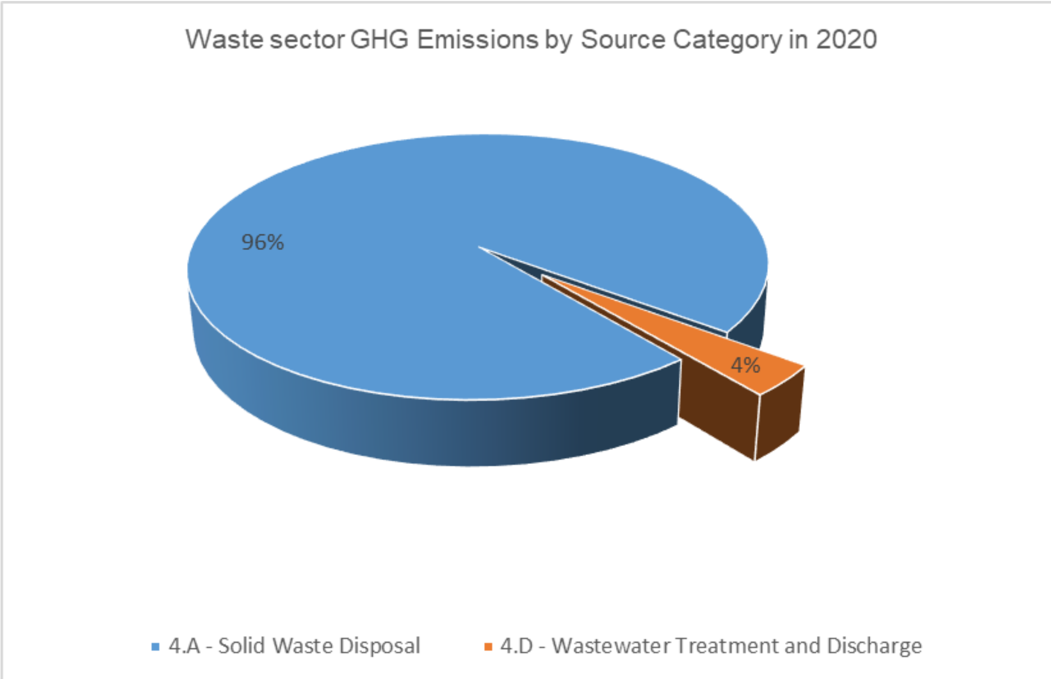


Figure 2-22: Total Waste sector emissions by source category in 2018 (Gg CO2e)

For the waste sector, the main gas emitted was CH4, accounting for 98%, with only 2% of the emissions coming from N2O (Figure 2-23).

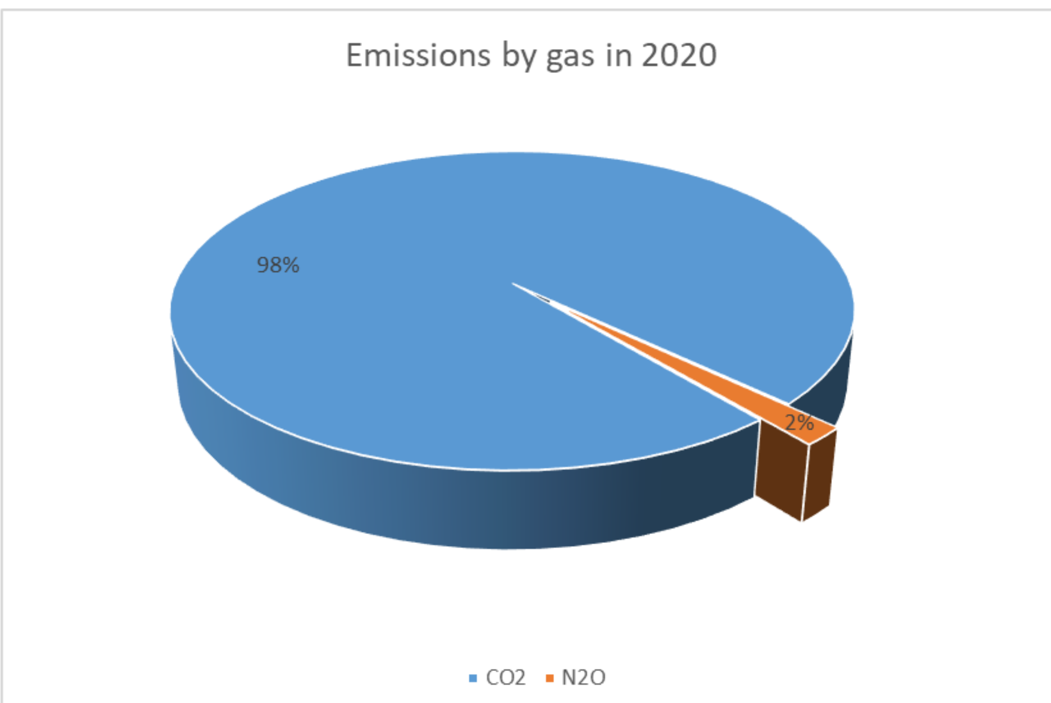


Figure 2-23: Waste Sector GHG emissions by gas in 2020

Waste generation in Seychelles has been on the rise due to population growth, increased importation of goods, and tourism. The average population increase from 2010 to 2020 is 2.14% per annum. The main driver for waste generation in Seychelles is the significant import of goods, especially the import of low-quality products with a short life span, as well as the lack of export of the related waste products, resulting in large waste stockpiles.

2.14 Energy

2.14.1 Sector Overview

Seychelles' energy sector is carbon-intensive and almost entirely dependent on oil for energy, including electricity production. According to the Strategic Approach towards 100% Renewable Energy in Seychelles' Energy report (2021), about 90% of all domestic CO2 emissions stem from power generation and the road transportation sector. Fossil fuels (primary energy source) account for about 94.8 %, with 5.2 % coming from renewables. The share of solar and wind power in the 2017 electricity mix is minor, with an installed capacity of 6 MW of wind generators and 3.5 MW of solar photovoltaics (IRENA, 2019). Seychelles aims to cover 15% of electricity with renewables by 2030 (Seychelles Energy Policy 2010-2030). In 2020, the total population (urban and rural) had access to electricity (Africa Energy Portal).

In 2007, about a third of oil imports were used for transport and almost two-thirds for electricity production. About 10% was used for direct consumption in the industry, commercial and domestic sectors. In 2012, the share of renewable energy in the total final energy consumption was 0.5%, increasing to 2.5% in 2013 owing to wind. In 2014, 2.15% of renewable electricity was generated in Seychelles. The Seychelles Petroleum Company (SEYPEC) met all the other energy needs from imported fossil fuels.

In 2012, Electricity consumption was distributed as follows: 85% -domestic/residential sector, 4%- government and 11% industry and commerce (Renewable Energy and Energy Efficiency Partnership (REEP) (2012). In 2006, 36% was used by industrial/ commercial customers, 32.7% by households, 19.3% by the government, and 0.4% for street lighting.

According to the SNC, 95% of all national emissions occurred in the energy sector in 2000 (Seychelles, 2011). The remaining 5% of national emissions was accounted for by forestry. Public electricity and transport generation accounted for 82.0% and 82.8% of all emissions in 2000 and 2007, respectively. In 2000, emissions related to fuel combustion in cooking represented 6% of national emissions.

A summary of the emission estimates in the energy sector is provided in Table 2-14.

Table 2. 15: GHG Emissions from Seychelles in 2020

	Emissions (Gg)						
Categories	CO_2	CH_4	N_2O	NOx	CO	NMVOCs	SO_2
1 - Energy	514.27	0.06	0.01	0.96	62.76	1.45	4.76
1.A - Fuel Combustion Activities	514.27	0.06	0.01	0.96	62.76	1.45	4.76
1.A.1 - Energy Industries	285.18	0.01	0.00	0.24	0.06	0.00	0.17
1.A.1.a - Main Activity Electricity and Heat Production	285.18	0.01	0.00	0.24	0.06	0.00	0.17
1.A.1.a.i - Electricity Generation	285.18	0.01	0.00	0.24	0.06	0.00	0.17
1.A.2 - Manufacturing Industries and Construction	14.13	0.00	0.00	0.09	0.012	0.00	0.01
1.A.3 - Transport	144.99	0.04	0.01	0.72	62.04	1.28	4.69
1.A.3.a - Civil Aviation	12.20	0.00	0.00	0.19	58.41	0.92	0.05
1.A.3.b - Road Transportation	114.68	0.04	0.01	0.51	3.56	0.35	0.00
1.A.3.d - Water-borne Navigation	18.11	0.00	0.00	12.54	0.67	0.30	0.32
1.A.4 - Other Sectors	69.96	0.01	0.00	0.24	0.72	0.17	0.07
1.A.4.a - Commercial/Institutional	59.56	0.01	0.00	0.23	0.072	0.017	0.07
1.A.4.b - Residential	10.40	0.00	0.00	0.01	0.00	0.00	0.00
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.2 - Oil and Natural Gas	NO	NO	NO	NO	NO	NO	NO
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

In 2020, CO2 was the dominant GHG, contributing more than 99.24% of total emissions from the energy sector. Emissions from CH4 and N2O contributed 0.27% and 0.50%, respectively (Figure 2-24). The dominance of CO2 is attributed to the high consumption of fossil fuels in Seychelles' energy sector.

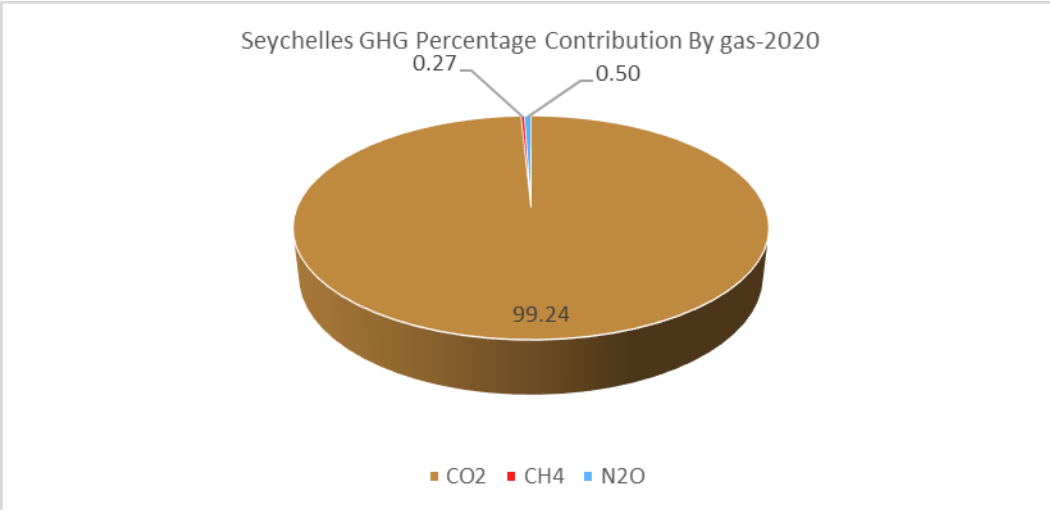


Figure 2-24: Seychelles' Energy sector GHG Percentage Contribution by gas – 2020

2.14.2 Energy Trends

There was a steady increase in GHG emissions for the whole time series, with emissions rising from 259 Gg CO2eq in 2000 to 543 Gg CO2eq in 2019 owing to increased consumption of fossil fuels, with a slight decrease to 472 Gg CO2eq owing to Covid -19 pandemic in 2020 (Figure 34). In 2020, the Energy industries dominated the GHG emissions of Seychelles' Energy Sector, contributing over 63% of the total emissions throughout the time series. Energy industries were followed by the transport sector (1A3), which contributed to 24% of the total emissions. Other sectors (1A4) that included Residential (1A4b) and Commercial/Institutional (1A4a) contributed 10% of the total emissions. Manufacturing Industries and Construction (1A2) contributed the most negligible emissions, amounting to less than 3% of Seychelles' emissions from the energy sector.

There was a steady increase in GHG emissions for the whole time series, with emissions rising from 250 Gg CO2eq in 2000 to 543 Gg CO2eq in 2019 owing to increased consumption of fossil fuels, with a slight decrease in 2020 as a result of Covid 19 (Figure 2-25). Energy industries dominated the GHG emissions of Seychelles' Energy Sector, contributing around 50% of the total emissions throughout the time series. Energy industries were followed by the transport sector (1A3), which contributed 30% of the total emissions. Other sectors (1A4), which included Residential (1A4b) and Commercial/Institutional (1A4a), contributed 15% of the total emissions. Manufacturing Industries and Construction (1A2) contributed the most negligible emissions, amounting to less than 5% of Seychelles' emissions from the energy sector.

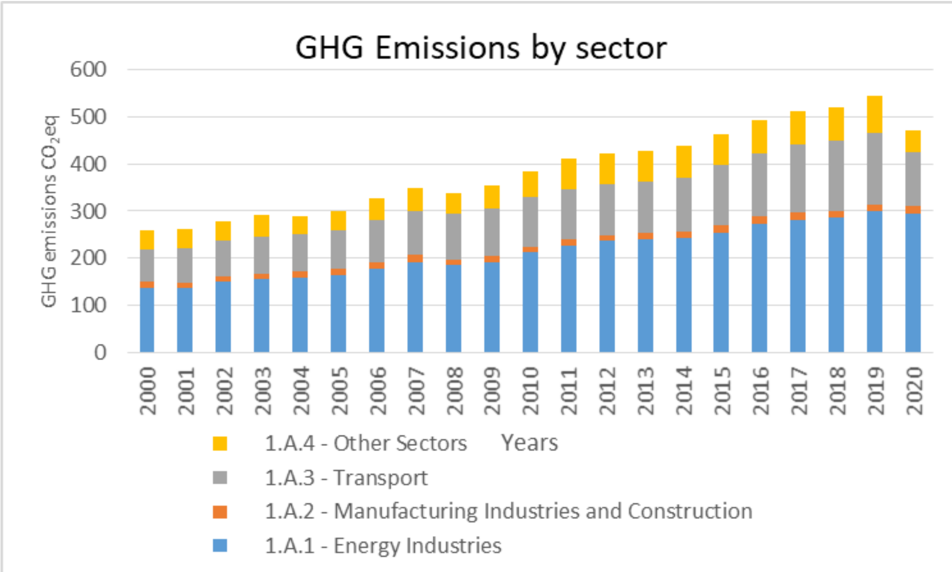


Figure 2-25: GHG Emissions by category

CO2 was the dominant GHG, contributing 99.24% of the total emissions from the energy sector (Figure 2-26). Emissions from CH_4 and N_2O contributed a total of 0.77% combined. The dominance of CO_2 is attributed to increased consumption of HFO and diesel in Seychelles' energy sector.

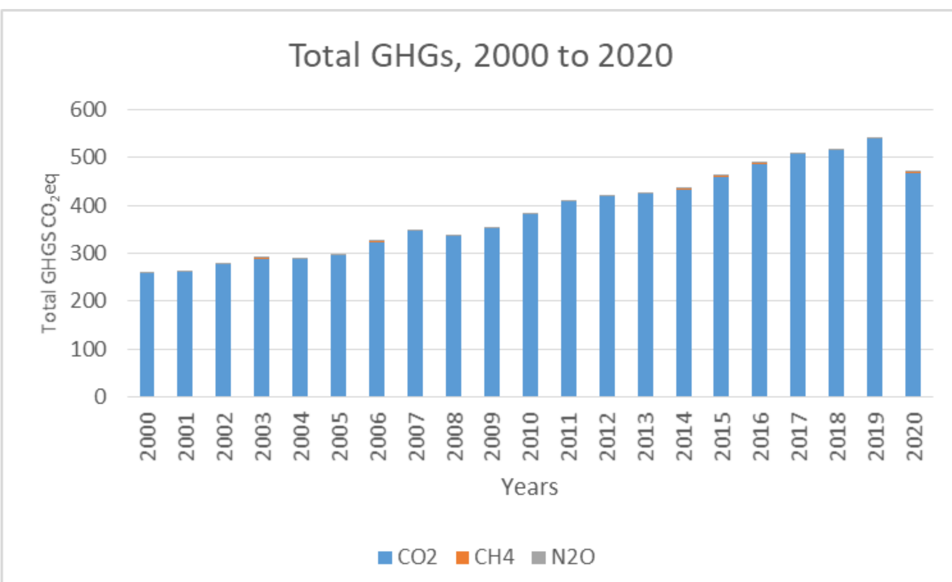


Figure 2-26: Seychelles total GHG emissions (2000 to 2018)

Methods, data sources, and assumptions

The classification of energy categories followed the 2006 IPCC Guidelines. The classification of energy sector activities was namely: Fuel combustion - 1A; Fugitive emissions from fuels – 1B and; Carbon dioxide transport and storage – 1C. Carbon dioxide transport and storage did not occur in Seychelles. Tier 1 methodology from the 2006 IPCC Guidelines and default emission factors were applied for all categories to calculate major GHGs (Table 2-16). This approach was attributed to the unavailability of country-specific emission factors. Precursor gases were calculated using equations and default emissions from the EMEP/EEA 2019 Guidelines.

Table 2. 16: Categorization of energy sector activities

GREENHOUSE GAS SOURCE CATEGORIES	CO_2		CH_4		N_2O	
	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor
1.A. Fuel combustion	T1	D	T1	D	T1	D
1. Energy industries	T1	D	T1	D	T1	D
2. Manufacturing industries and construction	T1	D	T1	D	T1	D
3. Transport	T1	D	T1	D	T1	D
4. Other sectors	T1	D	T1	D	T1	D
5. Other	T1	D	T1	D	T1	D

NB* T1 is Tier 1; D is Default

2.15 Fuel combustion activities

This section includes GHG emissions from four sources: energy industries (1.A.1); manufacturing industries and construction (1.A.2); transport (1. A.3); other sectors (1. A.4). Emissions from the energy industries (1.A.1) increased by 115.73% between 2000 and 2020. In manufacturing industries and construction (1.A.2), GHG emissions rose by 14.43% from 2000 to 2020, while emissions from transport (1.A.3) increased by 67.0% in 2020 compared to 2000. Emissions from other sectors (1.A.4) increased by 15.16% from 2000 to 2020.

2.15.1 Category 1A1 – Energy Industries

The main activity is electricity and heat production (1 A 1 a). Seychelles' electricity generation is dominated by residual fuel oil and diesel. As a result, CO2 emissions dominate the emissions from the Energy Industries category, accounting for more than 99.67% of the emissions. A smaller proportion of N2O and CH4 emissions contributed 0.23% and less than 0.10%, respectively. There has been a gradual increase in GHG emissions from 2000 to 2020, with more than a 100% increase from 2000 to 2020 (Figure 2-27).

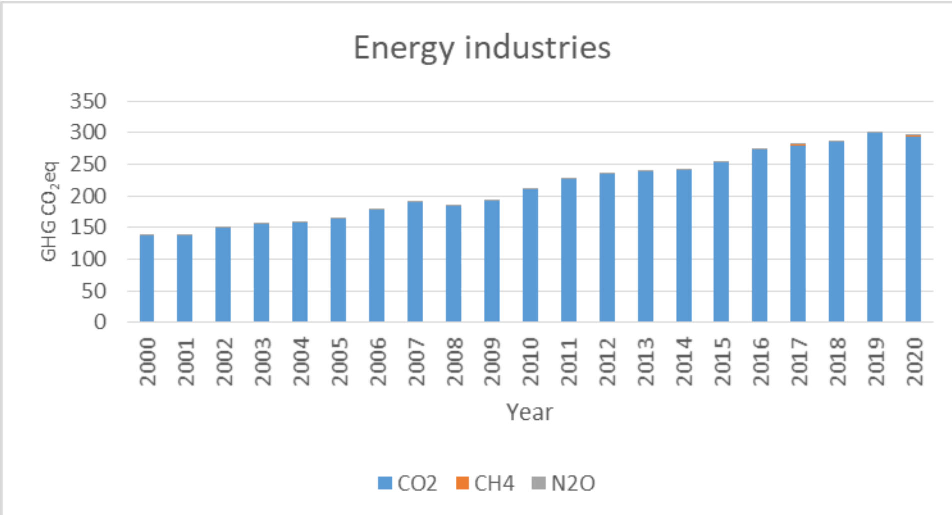


Figure 2-27: Energy Industries emissions

a) Methodological issues

Estimating GHG emissions from Energy Industries was based on the 2006 IPCC Guidelines Tier 1 methodology, following the decision tree in Figure 2.1 in Chapter 2, Volume 2 of the 2006 IPCC Guidelines.

b) Activity data

Activity data on the consumption of diesel and Residual Fuel Oil (RFO) in Energy Industries were obtained from SEYPEC. It covered the years 2000 to 2020 (Table 2-17).

Table 2. 17: Activity data for the production of electricity from diesel and fuel oil

Fuel	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Diesel	kt	15.59	6.57	7.96	10.78	9.83	14.8	9.91	10.9	9.7	10.14	15.3
Residual Fuel Oil	kt	27.8	37.3	39.56	38.6	40.55	37.41	46.58	49.49	49.16	51.12	51.93
Fuel	**Unit**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	
Diesel	kt	11.37	9.83	9.45	8.94	10.6	11.02	11.63	11.67	12.52	10.65	
Residual Fuel Oil	kt	61.07	65.35	66.96	67.99	70.26	76.1	77.81	79.31	83.16	83.40	

Source: SEYPEC, 2021

c) Emission Factors

The default emission factors used were obtained from the 2006 IPCC Guidelines, Table 2.2 of Volume 2 Chapter on stationery combustion (Table 2-18). Seychelles has not yet developed country-specific emission factors for electricity generation.

Table 2. 18: Emission Factors for production of electricity from diesel and Residual Fuel Oil

Gas (kg/TJ)	CO_2 kg/TJ	CH_4 kg/TJ	N_2O kg/TJ	Comment
Diesel	74100	3	0.6	Default emission factor from 2006 IPCC Guidelines was applied
Residual Fuel Oil	77 400	3	0.6	

Source: IPCCC, 2007

2.15.2 Manufacturing Industries and Construction -1A2

GHG emissions from fuel combustion in the Manufacturing Industry and Construction (1A2) are covered in this section. GHG emissions from this source category were calculated as an aggregate total. The bulk of the emissions was CO2, accounting for 99.67%, with CH4 and N2O contributing less than 0.33%. There was a 14.45% increase in emissions from 2000 to 2020 (Figure 2-28). The emissions increased gradually from 2000 to 2007, after which they started declining before rising again and peaking in 2017. These variations are explained by varying quantities of HFO consumed in MIC.

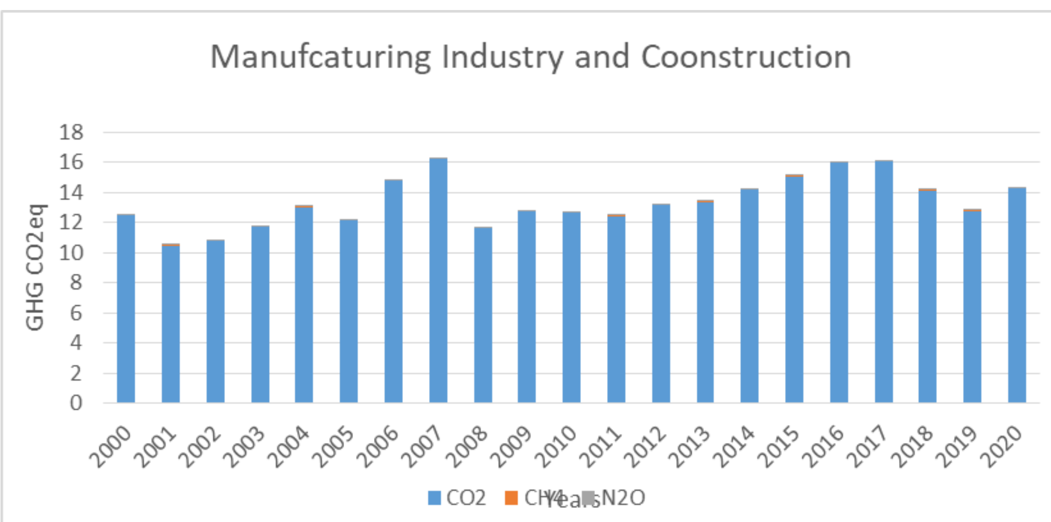


Figure 2-28: Manufacturing and Construction Industries' emissions

a. Methodological issues

The 2006 IPCC Guidelines Tier 1 methodology was used, according to Chapter 2, Volume 2 of the 2006 IPCC Guidelines.

b. Activity data

Fuel combustion data on energy use in the Manufacturing Industry were obtained from SEYPEC. Data on fuel consumption were obtained from SEYPEC (Table 2-19).

Table 2. 19: Manufacturing Industries and Construction Activity Data

Fuel	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Residual Fuel Oil	Gg	3.986	3.349	3.432	3.739	4.163	3.874	4.714	5.193	3.723	4.062	4.042
Fuel	**Unit**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	
Residual Fuel Oil	Gg	3.973	4.208	4.272	4.537	4.816	5.094	5.127	4.519	4.081	4.562	

Source: SEYPEC, 2023

c. Emission Factors

Default emission factors were applied, and these were obtained from Table 2.3 of Chapter 2, Volume 2 of the 2006 IPCC Guidelines (Table 2-20).

Table 2. 20: Manufacturing Industries and Construction Emission Factors

Emission factor	CO_2	CH_4	N_2O	Source
Heavy Fuel Oil (kg/TJ)	77,400	3	0.6	IPCC Default, T1

2.15.3 Transport emissions (1A3)

GHG emissions from fuel combustion in the Transport sector (1 A 3) are reported in this section. CO2 emissions dominated the emissions from the Transport sector, contributing more than 98% of the emissions, owing to the high use of gasoline and diesel in road transport. Combined N_2O and CH4 emissions contributed less than 2%. There has been a gradual increase in the emissions from 2000 to 2020, with 70 Gg GHG CO2eq in 2000 and rising to around 150 Gg GHG CO2eq in 2019. There was a slight decline in 2020 due to COVID-19 (Figure 2-29).

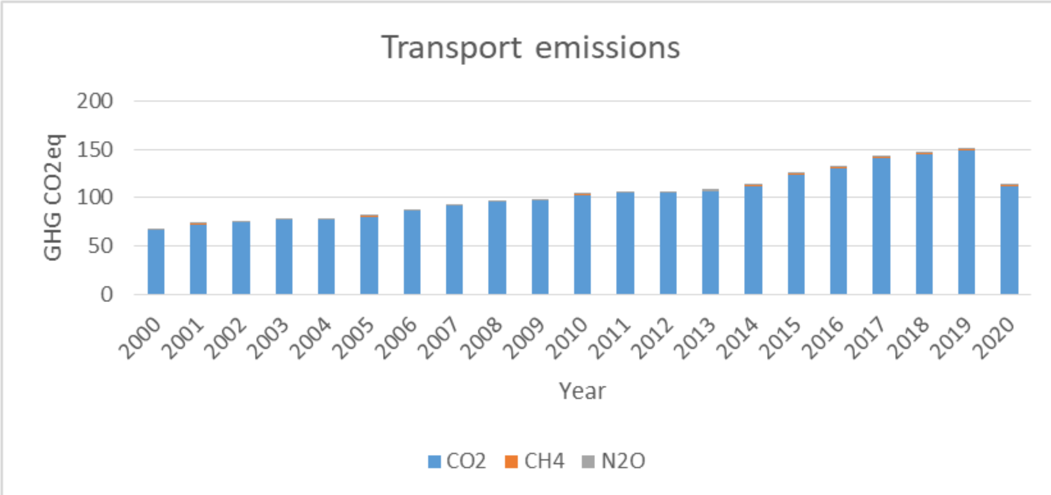


Figure 2-29: Transport emissions

2.15.4 Category 1A3a – Aviation

Emissions from fuel combustion from International (International Bunkers) (1. A.3. a. i) and Domestic Aviation (1.A.3.a.ii) are reported in this section. Emissions from fuel use at airports were not reported due to a lack of disaggregated data.

Emissions from International Aviation were not added to the Seychelles's national totals per UNFCCC reporting and 2006 IPCC Guidelines. However, these emissions were reported as Memo Items (Section 3.3.5). These emissions have been growing in recent years due to increased sector activity.

a. Methodological issues

Data on emission factors could not be obtained locally. Hence, the 2006 IPCC Guidelines Tier 1 default emission factors were used following the decision tree Figure 3.6.1 and Equation 3.6.1.

b. Activity data

Activity data for fuel consumed in international aviation were obtained from SEYPEC, covering 2000 to 2020 (Table 2-21).

Table 2. 21: International Aviation (International Bunkers) Activity Data

Fuel	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Jet Kerosene	Gg	25.71	26.76	30.21	31.41	32.72	30.98	26.42	32.384	39.125	41.666	45.354
Fuel	**Unit**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	
Jet Kerosene	Gg	40.95	28.12	28.30	29.12	39.51	43.88	55.07	48.673	47.377	19.375	

Source: SEYPEC, 2023

Activity data for fuel consumed in international aviation were obtained from SEYPEC (Table 2-22)

Table 2. 22: Domestic Aviation Activity Data

Fuel	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Jet Kerosene	Gg	2.189	2.14	2.03	2.02	2.12	2.09	2.27	2.39	2.32	1.88	2.12
Aviation Gasoline	Gg	0.122	0.12	0.15	0.03	0.07	0.04	0.03	0.05	0.05	0.05	0.03
Fuel	**Unit**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	
Jet Kerosene	Gg	2.04	1.98	2.01	2.05	2.28	2.29	2.5	3.86	3.456	1.512	
Aviation Gasoline	Gg	0.122	0.03	0.03	0.03	0.03	0.03	0	0.007	0.007	0.053	

Source: SEYPEC, 2023

c. Emission Factors

Default emission factors were used as provided in Table 3.6.4 Chapter 3, Volume 2 of the 2006 IPCC Guidelines, Table 2-23.

Table 2. 23: Aviation Emission factors

Emission factor	CO_2	CH_4	N_2O	Source	Comment
Aviation Gasoline (kg/TJ),	70,000	0.5	2	IPCC Default, T1	Default emission factor was applied
Jet Kerosene (kg/TJ)	71,500	0.5	2		

Source: (IPCC, 2006)

2.15.5 Category 1A3b – Road Transport

Road Transportation GHG emissions in Seychelles arise from Gasoline and Diesel combustion. The GHG emissions reported in the BUR cover the time series from 2000 to 2020. Data from 1990 to 1999 were not available. There has been a steady rise in emissions from around 2000 to 2019, with a slight decrease due to the COVID-19 effect in 2020 (Figure 2-30).

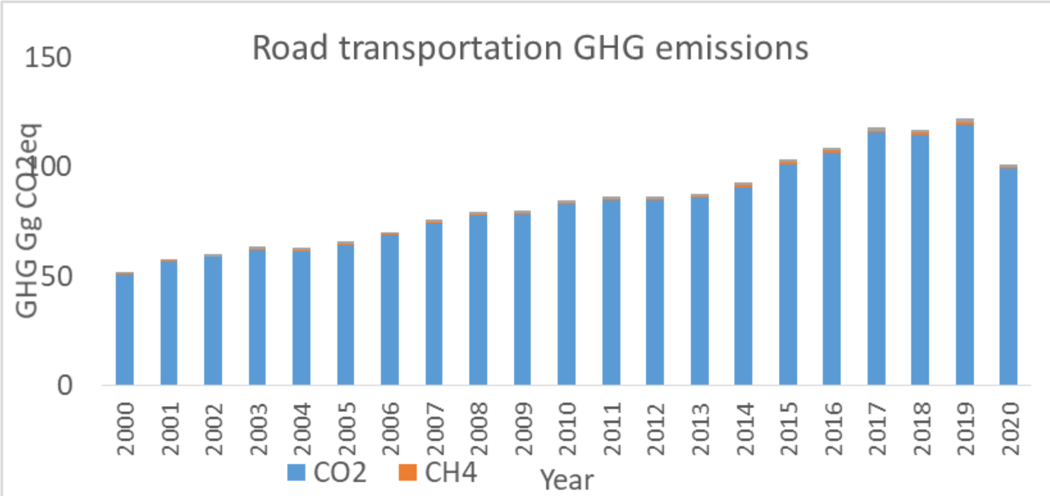


Figure 2-30: Road transport emissions

a. Methodological issues

The methodology was limited to the 2006 IPCC Guidelines default methodology as provided for in section 3.2.1 and equations 3.2.1 for CO2 as well as 3.2.3 for CH4 and N2O. Fuel consumption data could only be obtained as the total quantity consumed per fuel type and was not disaggregated by type of vehicle.

b. Activity data

The times series 2000 to 2020, data for diesel and gasoline covering the whole time series was obtained from SEYPEC (Table 2-24).

Table 2. 24: Road Transportation Activity Data

Fuel	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Motor Gasoline	Gg	10.61	11.52	11.34	11	11.36	11.5	12.36	13.15	12.87	12.88	13.97
Diesel	Gg	5.71	6.64	7.5	8.92	8.36	9.12	9.69	10.7	11.99	12.14	12.64
Fuel	**Unit**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	
Motor Gasoline	Gg	14.77	15.01	15.43	17.54	19.73	20.31	22.72	22.71	23.813	20.514	
Diesel	Gg	12.42	12.15	12.06	11.62	12.78	13.88	14.43	14.11	14.586	11.34	

Source: SEYPEC, 2023

c. Emission Factors

Default Emission Factors for Motor Gasoline and Diesel use in Road Transportation were obtained from the 2006 IPCC Guidelines, Volume 2 Table 3.2.1 (CO2) by the group of experts, while N2O and CH4 emission factors were obtained from Table 3.3.2 of the same guidelines. Decision tree Figure 3.2.2 was used for CO2, while Figure 3.2.3 was used for CH4 and N2O emissions.

Table 2. 25: Road Transportation Emission Factors

Emission factor	CO_2	CH_4	N_2O	Source
Diesel (kg/TJ)	74,100	3.9	3.9	IPCC Default, T1
Motor Gasoline (kg/TJ)	69,300	33	3.2	

- Water-borne Navigation-1A3d

Emissions from fuels used to propel water-borne vessels in Seychelles are reported in this section. Emissions from International Water-borne Navigation (International Bunkers) (1 A 3 d i) are not included here and are reported under memo items.

a) International water borne-1A3d.i

GHG emissions from Heavy Fuel Oil and diesel used in Seychelles are presented in Figure 40. These emissions were not added to the national totals per the UNFCCC reporting guidelines. The total emissions were highest in 2017, reaching 725.40 GgCO2eq, while they were lowest in 2004 at 417.39 GgCO2eq (Figure 2-31).

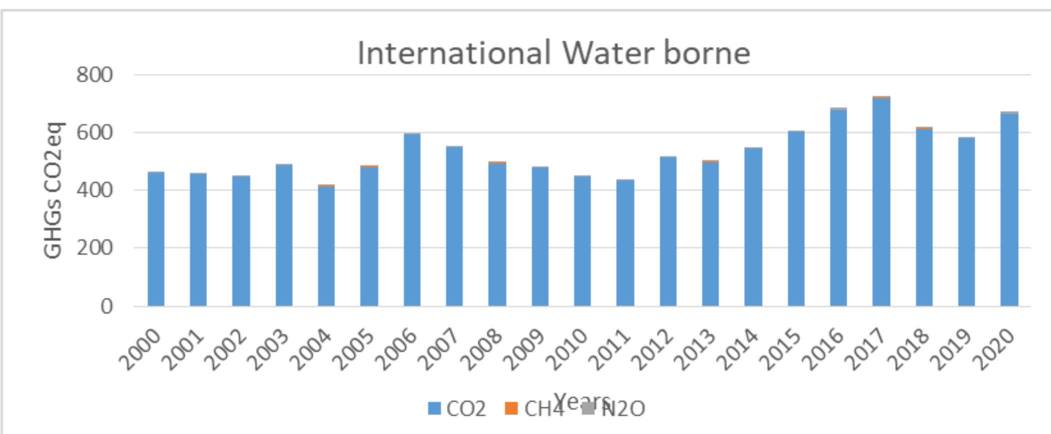


Figure 2-31: International water borne

a. Methodological issues

The methodology was limited to the 2006 IPCC Guidelines default methodology as provided in section 3.5.1 and Equations 3.5.1. Tier 1 methodology was employed following the decision tree (Figure 3.5.1).

b) Activity data

The times series data from 2000 to 2020 for Diesel and Residual Fuel Oil were obtained from SEYPEC (Table 2-26).

Table 2. 26: International Water-borne Navigation Activity Data

Fuel	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Gas/Diesel Oil	Gg	137.55	139.02	137.41	145.54	122.78	142.14	174.83	161.74	141.58	124.04	123.97
Residual Fuel Oil	Gg	6.87	3.66	2.87	7.47	7	8.48	10.88	10.68	13.36	25.93	16.12
Fuel	**Unit**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	
Gas/Diesel Oil	Gg	124.38	151.07	149.56	159.67	176.89	205.67	213.41	173.75	174.662	202.121	
Residual Fuel Oil	Gg	12.08	10	6.75	10.74	12.28	6.96	12.14	18.73	7.163	6.225	

Source: SEYPEC, 2023

c) Emission Factors

Default Emission Factors for Residual Fuel Oil and Diesel Oil Use in International Water-borne Navigation were obtained from Table 3.5.2 (CO2). In contrast, N2O and CH4 emission factors were obtained from Table 3.5.3 of the 2006 IPCC Guidelines, Volume 2 with Decision tree Figure 3.5.1 for CO2 and 3.2.3 for CH4 and N2O emissions.

Table 2. 27: International Water-borne Navigation Emission Factors

Emission factor	CO_2	CH_4	N_2O	Source	Comment
Gas/Diesel Oil (kg/TJ)	74,100	7	2	IPCC Default, T1	Default emission factor was applied
Residual Fuel Oil (kg/TJ)	77 400	7	2		

d) Domestic Water-borne Navigation (1 A 3 d ii)

Emissions from fuels used by vessels of all flags that depart and arrive in the same country (exclude fishing, which should be reported under 1 A 4 c iii, and military, which should be reported under 1 A 5 b). Total emissions from navigation increased from 9.0 GgCO2eq in 2000 to 18.79 GgCO2eq in 2019. Carbon dioxide accounted for around 99% of the emissions (Figure 3.3.3.4). 2020 shows a significant decrease in GHG emissions at 7.68 GgCO2eq due to the COVID-19 effect (Figure 2-32).

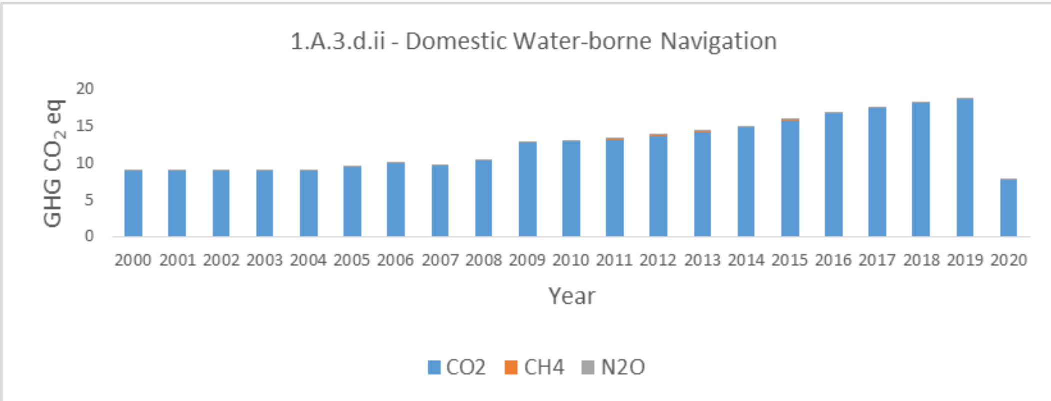


Figure 2-32: GHG emissions from water-borne navigation

a. Methodological issues

The methodology was limited to the 2006 IPCC Guidelines default methodology as provided in section 3.5.1 and Equation 3.5.1. Tier 1 methodology was employed following the decision tree (Figure 3.5.1).

b. Activity data

The times series data from 2000 to 2020 for Diesel and Residual Fuel Oil were obtained from SEYPEC (Table 2-28).

Table 2. 28: Domestic Water-borne Navigation Activity Data

Fuel	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Gas/Diesel Oil	Gg	2.798	2.8	2.8	2.8	2.8	2.948	3.113	3.027	3.219	4.001	4.032
Fuel	**Unit**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	
Gas/Diesel Oil	Gg	4.118	4.282	4.445	4.653	4.939	5.222	5.475	5.683	5.837	2.387	

Source: SEYPEC, 2023

c. Emission Factors

Default Emission Factors for Diesel Use in Domestic Water-borne Navigation were obtained from Table 3.5.2 (CO2), while N2O and CH4 emission factors were obtained from Table 3.5.3 of the 2006 IPCC Guidelines. Decision tree Figure 3.5.1 was used for CO_2, while that of 3.2.3 was used for CH_4 and N_2O emissions.

Table 2. 29: Domestic Water-borne Navigation Emission Factors

Emission factor	CO_2	CH_4	N_2O	Source
Diesel (kg/TJ)	74,100	7	2	IPCC Default, T1

2.15.6 Category 1A4a – Other Sectors

1) 1A4a Commercial/Institutional

GHG emissions from fuel combustion in the Commercial and Institutional sectors are reported in this section. The dominant energy source used is diesel oil. Emissions from Other sectors (1A4) steadily rose over the whole time series (Figure 2-33). CO2 emissions contributed 99.46% of the total emissions. N_2O and CH_4 contributed 0.32% and 0.22% of the emissions, respectively.

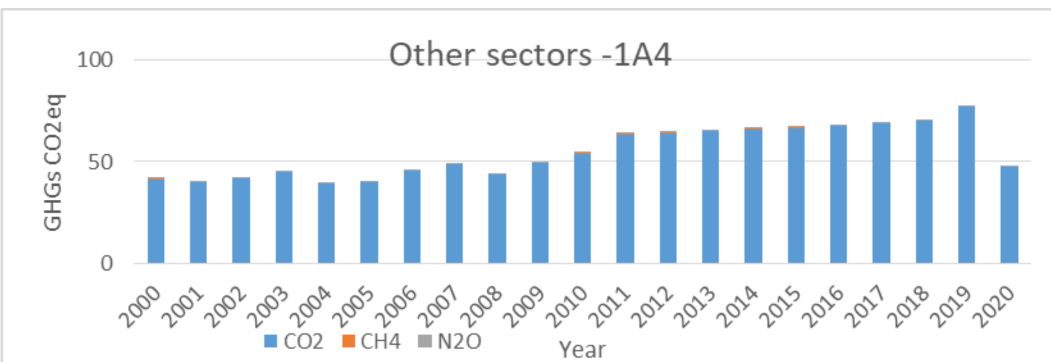


Figure 2-33: GHG emissions from 1A4

a) Methodological issues

The 2006 IPCC Guidelines Tier 1 methodology was used in calculating GHG emissions in commercial and institutional sectors following the application of the decision tree (Figure 2.1) and Equation 2.1 in Chapter 2 of Volume 2.

b) Activity data

Activity data on mainly two fuels, Diesel and Liquefied Petroleum Gases, were obtained from SEYPEC.

Table 2. 30: Commercial/Institutional Activity Data

Fuel	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Gas/Diesel Oil	Gg	9.89	9.08	9.74	10.72	8.96	9.2	10.72	11.54	9.96	11.6	13.3
Liquefied Petroleum Gases	Gg	0.34	0.24	0.34	0.39	0.43	0.5	0.61	0.72	0.77	0.82	0.73
Fuel	**Unit**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	
Gas/Diesel Oil	Gg	16	16.2	16.4	16.6	16.8	17	17.2	17.4	19.525	10.3	
Liquefied Petroleum Gases	Gg	0.97	1.25	1.28	1.3	1.27	1.26	1.34	1.38	1.383	1.365	

Source: SEYPEC, 2023

c) Emission Factors

The emission factors were obtained from the IPCC Guidelines, Vol 2, Chapter 2, Table 2.2

Table 2. 31: Commercial/Institutional Emission Factors

Emission factor	CO_2	CH_4	N_2O	Source	Comment
Diesel (kg/TJ)	74,100	10	0.6	IPCC Default, T1	Default emission factor was applied
Liquefied Petroleum Gas (kg/TJ)	63 100	1	0.1		

Residential-1A4b

GHG emissions from fuel combustion in the Residential sector are reported in this section. The dominant energy source used was Diesel oil.

a. Methodological issues

The 2006 IPCC Guidelines Tier 1 methodology was used in calculating GHG emissions in the Residential sector following the application of Decision Tree Figure 2.1 and Equation 2.1 in Chapter 2 of Volume 2.

b. Activity data

Activity data on mainly two fuels,, namely, kerosene and liquefied petroleum gases, were obtained from SEYPEC.

Table 2. 32: Residential Activity Data

Fuel	Unit	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Other Kerosene	Gg	0.83	0.62	0.53	0.42	0.33	0.26	0.21	0.2	0.14	0.12	0.13
Liquefied Petroleum Gases	Gg	2.08	2.74	2.7	2.71	2.72	2.71	2.9	2.97	2.98	3.15	3.04
Fuel	**Unit**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	
Other Kerosene	Gg	0.1	0.08	0.06	0.06	0.06	0.07	0.06	0.098	0.061	0.03	
Liquefied Petroleum Gases	Gg	3.07	2.84	2.91	2.99	3.07	3.15	3.23	3.38	3.465	3.569	

Source: SEYPEC, 2023

c. Emission Factors

The emission factors were obtained from the IPCC Guidelines, Vol 2, Chapter 2, Table 2.2

Table 2. 33: Residential Emission Factors

Emission factor	CO_2	CH_4	N_2O	Source	Comment
Other Kerosene (kg/TJ)	71 900	3	0.6	IPCC Default, T1	Default emission factor was applied
Liquefied Petroleum Gas (kg/TJ)	63 100	1	0.1		

d. Time series consistency

The emissions were calculated consistently in the all-time series. All data were obtained from SEYPEC, while methodologies and emission factors were obtained from the 2006 IPCC Guidelines.

The carbon emission factors of all energy sources were calculated by a consistent estimation method in the all-time series. Net calorific values used were consistent for all years. General inventory QC procedures were conducted per the 2006 IPCC Guidelines.

e. Memo items

The memo items recorded were International Aviation (International Bunkers) and International Water-borne Navigation (International Bunkers). Emissions peaked in 2017 with 900 Gg of GHG CO2eq. International Water-borne Navigation (International Bunkers) dominated, with an estimated 91.5% of total emissions from Memo items. As in all other sectors, CO_2 remained the dominant GHG in the Memo items.

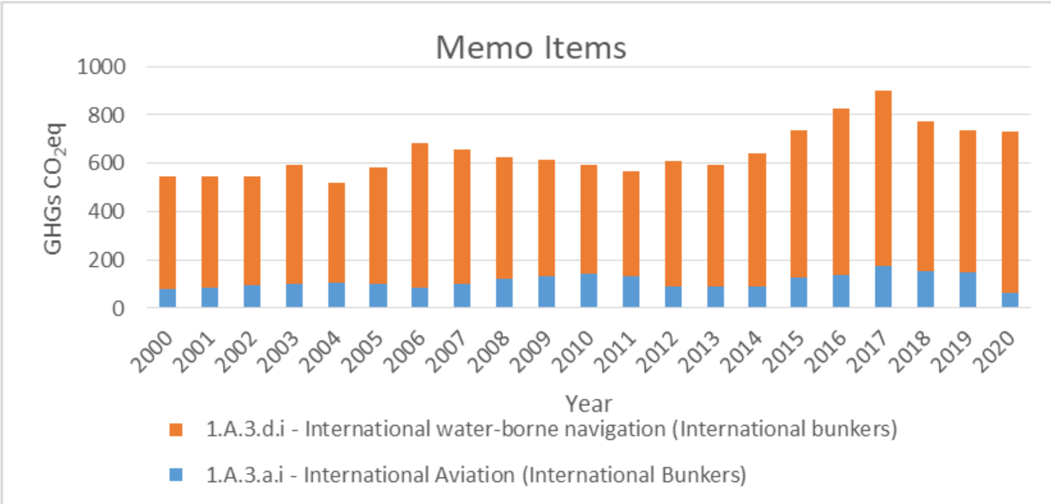


Figure 2-34: Memo Items

International Aviation (International Bunkers) had an uneven time series, peaking twice in 2010 and 2017 (Figure 2-35), owing to activities in the international aviation category. CO_2 made up the bulk of the emissions, contributing more than 99.2%. N_2O emissions made up 0.8%, with CH4 contributing an insignificant amount to the total emissions from International Aviation.

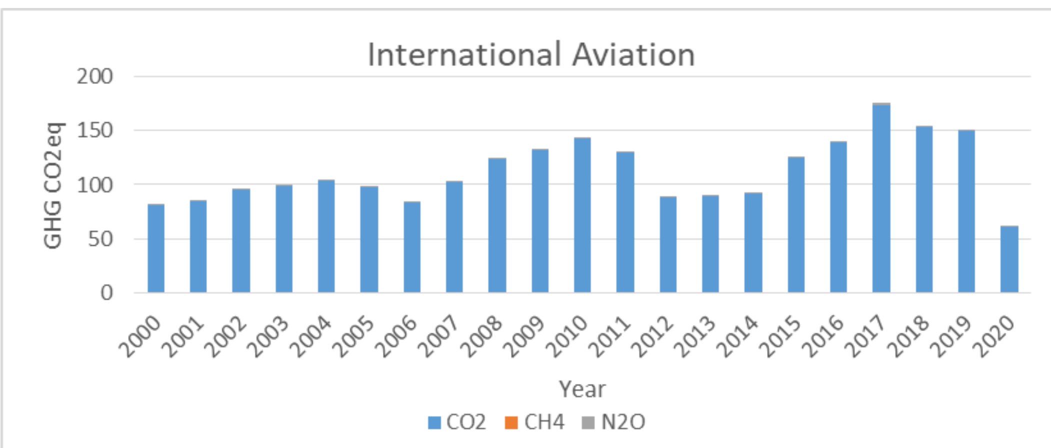


Figure 2-35: International Aviation (International Bunkers)

International Water-borne Navigation (International Bunkers) had an uneven time series, peaking twice in 2006 and 2017 (Figure 2-36) owing to activities in the International Water-borne Navigation category. CO2 comprised the bulk of the emissions, contributing more than 99.9% of the total emissions from International Water-borne Navigation (International Bunkers), with N2O and CH4 emissions making up the remaining percentage.

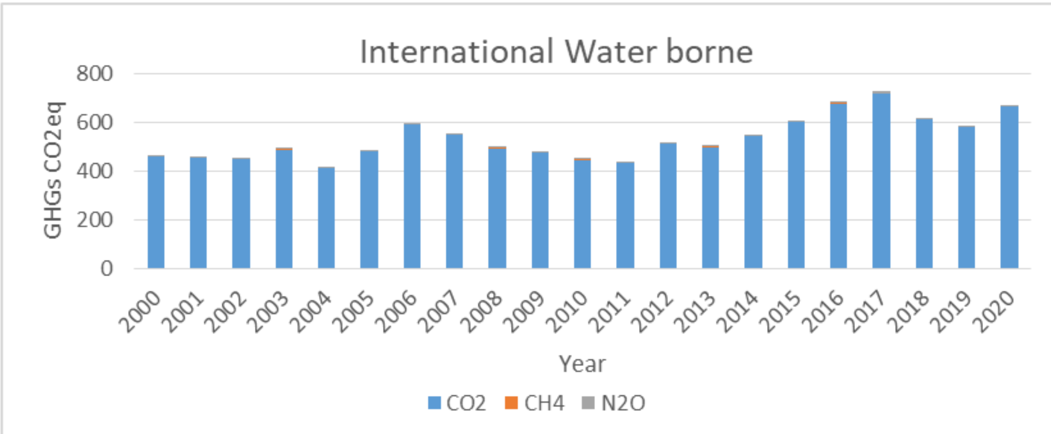


Figure 2-36: International Water-borne Navigation (International Bunkers)

f. Precursor gases

a. Methodological issues

The 2006 IPCC Guidelines Tier 1 methodology was used in calculating GHG emissions in the Residential sector following the application of Decision Tree Figure 2.1 and Equation 2.1 in Chapter 2 of Volume 2.

b. Activity data

Activity data on mainly two fuels, Other Kerosene and Liquefied Petroleum Gases, were obtained from SEYPEC.

2.15.6.1 Precursors Emission Factors and Trend Emissions

a. Energy Industries precursors

The emission factors were obtained from the IPCC Guidelines, Vol 2, Chapter 2, Table 2.2

Table 2. 34: EFs 1.A.1.a public electricity and heat production precursors

Emission factor (g/GJ)	NOx	NMVOC	SOx	CO
Heavy Fuel oil	142	2.3	495	15.1
Diesel	65	0.8	46.5	16.2

Source: (EEA, 2019)

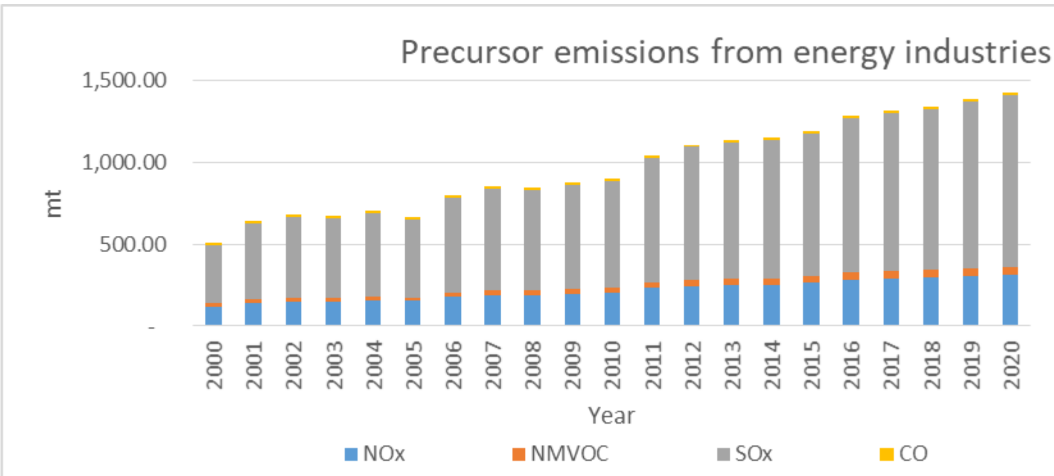


Figure 2-37: Precursor emissions from energy

b. 1.A.2 - Manufacturing Industries and Construction Precursors

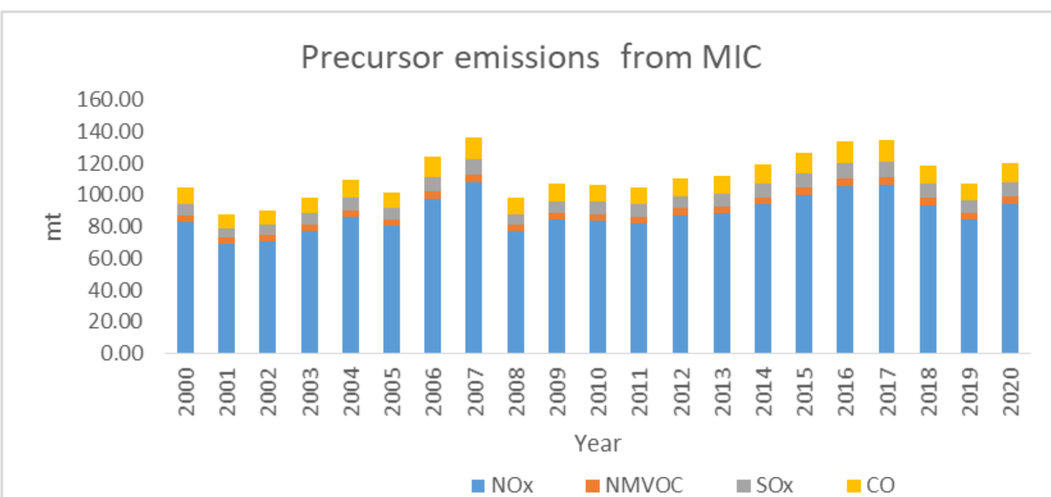


Figure 2-38: Precursor emissions from MIC

Table 2. 35: Emission factors for precursors

Emission factor (g/GJ)	NOx	NMVOC	SOx	CO
Solid Fuels	173	88.8	900	931
Gaseous Fuels	74	23	0.67	29
Liquid Fuels	513	25	47	66
Biomass	91	300	11	570

Source: (EEA, 2019)

Emission Factors (EF) for Manufacturing Industries and Construction for Solid Fuels, Gaseous Fuels, Liquid Fuels, and Biomass were obtained from the 2019 EMEP-EEA Air Pollutants Emission Inventory Guidebook; Table 3-1; Table3-2; Table 3-3 and Table 3-4 respectively, Part B: Sectoral Guidance Chapter 1 Energy Industries (1.A.2- MIC).

2.15.6.1.1 Aviation

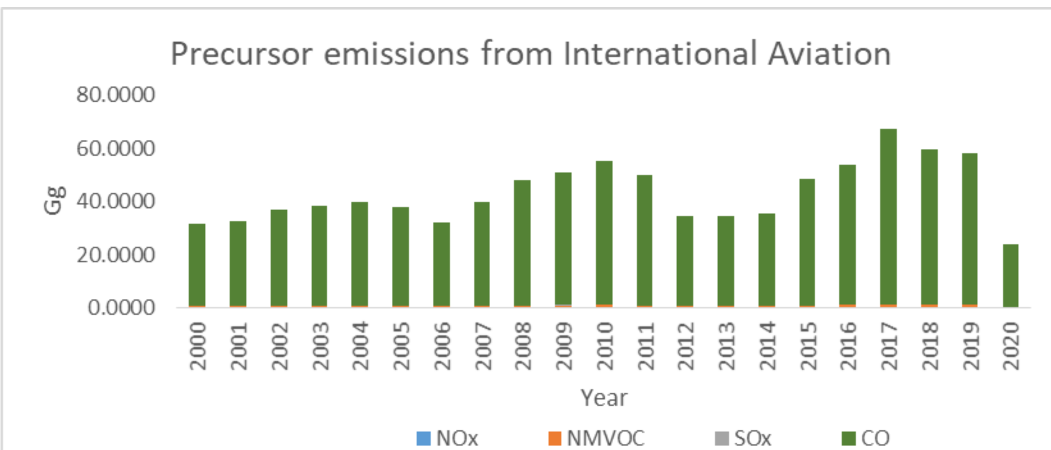


Figure 2-39: Precursors from aviation

Table 2. 36: Emission factors for precursors

Emission factor (kg/t fuel)	NOx	NMVOC	SOx	CO
Jet gasoline and aviation Gasoline	4	19	1	1200

Source: (EEA, 2019)

EFs for Aviation were obtained from the 2019 EMEP-EEA Air Pollutants Emission Inventory Guidebook, Table 3.3, Part B: Sectoral Guidance Chapter 1 Energy Industries (1.A.3.a – Aviation).

2.15.6.1.2 Road Transportation

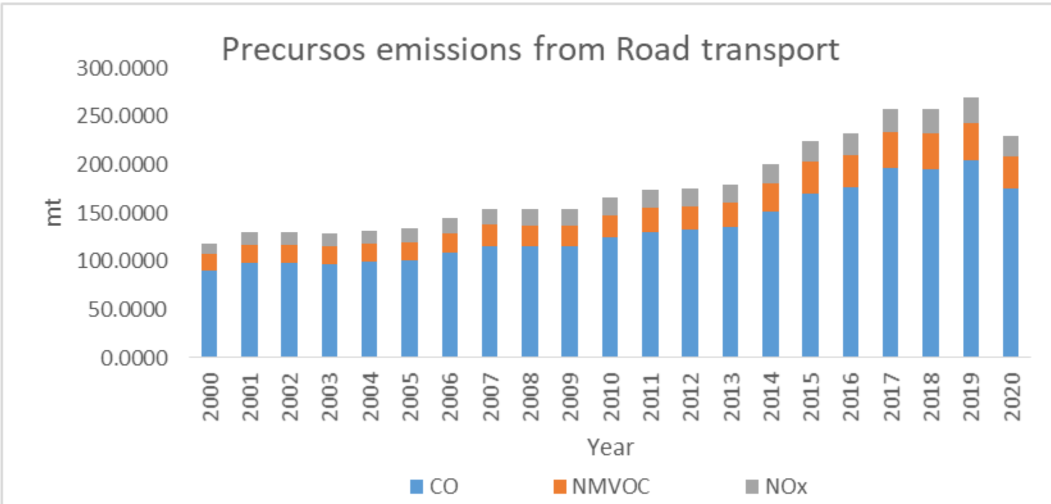


Figure 2-40: Precursor emissions from Road transport

Table 2. 37: Emission factors for precursors

Emission factor (kg/TJ)	NOx	NMVOC	CO
Gasoline	600	1500	8000
Diesel	800	200	1000

Source: (IPCC, 1996)

EFs for Road Transportation were obtained from the 2019 EMEP-EEA Air Pollutants Emission Inventory Guidebook, Table 3-5 for NMVOC and Table 3-6 for NOx, Part B: Sectoral Guidance, Chapter 1 Energy Industries (1.A.3.b- Road Transportation).

2.15.6.1.3 Residential

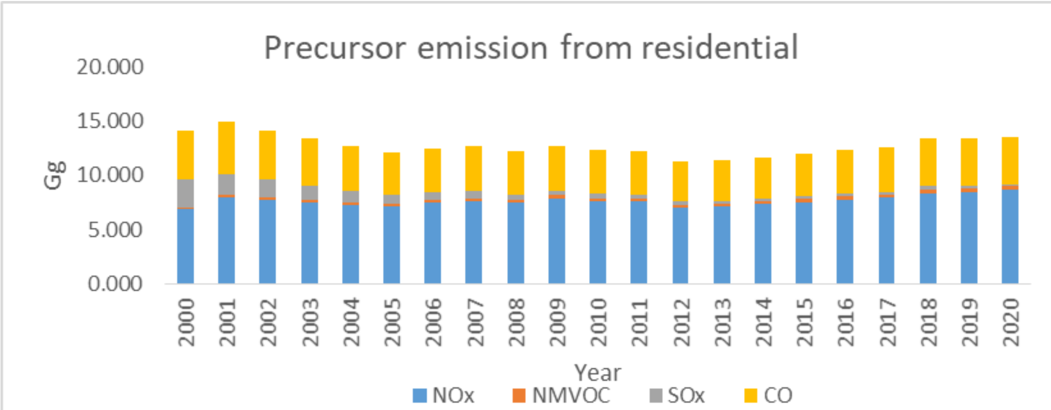


Figure 2-41: Precursor emission from residential

Table 2. 38: Emission factors for precursors

Emission factor (g/GJ)	NOx	NMVOC	SOx	CO
Gaseous Fuels	51	1.9	0.3	26
Other Liquid Fuels	51	0.69	70	57
Solid Biomass	50	600	11	4000

Source: (EEA, 2019)

EFs for Residential were obtained from the 2019 EMEP-EEA Air Pollutants Emission Inventory Guidebook, Table 3.3 to 3.5, Part B: Sectoral Guidance, Chapter 1 Energy Industries (1. A.4.bi-Residential Plants).

Comparison between sectoral and reference approaches

This chapter explains a comparison between the reference approach and sectoral approach per the UNFCCC Inventory Reporting Guidelines (Decision 17/CP.8). For the methodological issues of the sectoral approach, and please refer to section 3.2.4. b.

Methodological Issues of the Reference Approach

The reference approach is to calculate the CO_2 emissions from combustion using a country's energy supply data. The CO_2 emissions estimated by the reference approach are not included in the national total but were used for verification purposes. The following formula estimates the CO_2 emissions by the reference approach:

The following formula estimates the apparent energy consumption A:

Apparent consumption = (Production) + (Imports) – (Exports) - (Stock change/supply)-(International bunkers)

Equation 3.7.1 1: Apparent consumption

Differences in Energy Consumption

Generally, there are significant differences between the Reference and the Sectoral approaches for all fuels. The differences for jet kerosine were large (704.95 in 2001) (-1119.06% in 2002 and 1167.06% in 2020). Fluctuations in the differences were recorded in all other fuels except for other kerosine and RFO. Differences in other kerosine were consistently negative (around negative 200%), with the year 2020 having positive values.

These differences are mainly due to:

- Differences in the methodological approach;

- Different quantities of consumed fuels, including not taking into account the losses during fuel transformation in the sectoral approach;

- Different conversion factors for fuel conversion from natural units to energy units;

- Different emission factors for different combustion technologies used in the sectoral approach.

It should be noted that to comply with new international standards, a significant modification was made to the energy balance for 2019. That was the transfer of 'international aviation' from national air transport to 'International Marine & Air Bunkers.' This was adopted as the new framework for the future. In the years before 2019, the national Transport sector accounted for fuel consumed by international aviation such as Emirates and Air Seychelles' non-domestic flights.

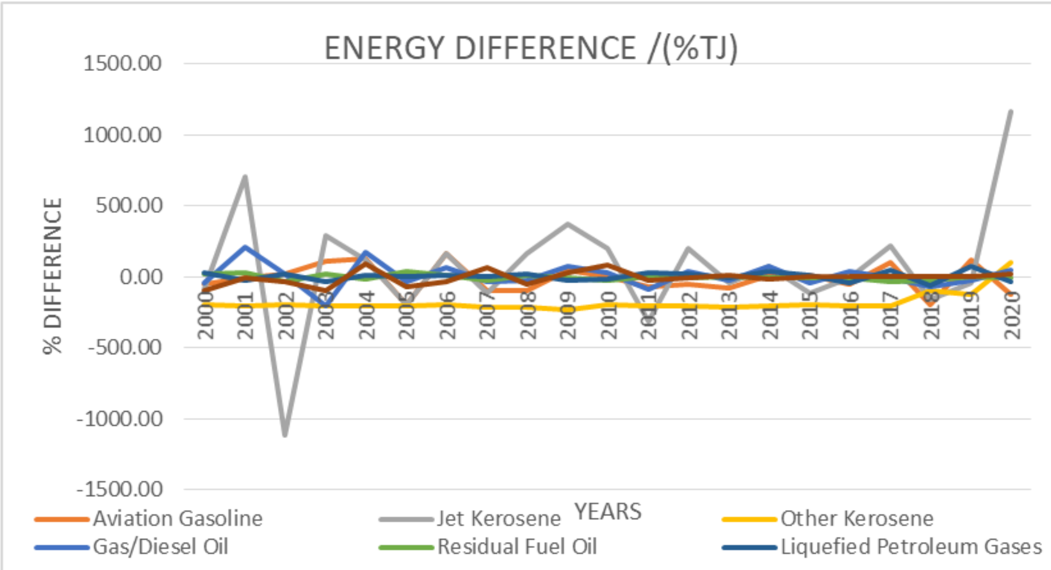


Figure 2-42: Differences between RA and SA

Fugitive Emissions from Solid Fuels-1B1

Emissions from this category do not occur in Seychelles.

Quality assurance and quality control

QA/QC Procedures Applied

When compiling the inventory in Seychelles, inventory quality is controlled by performing QC activities (such as checking the correctness of calculations and archiving documents) at each step per the 2006 IPCC Guidelines. In Seychelles, the QC activities relating to inventory compilation performed by the personnel involved in inventory compilation, relevant ministries, and agencies—are considered QC. External reviewers outside the inventory compilation system conducted the QA. They assessed data quality and recommended ways to improve and close the gaps.

Following Table 6.1, Chapter 6, Vol.1 of the 2006 IPCC Guidelines, general QC procedures performed by the compiler included:

- Checking for transcription errors in data entry and referencing
- Checking to ensure that emissions are accurately estimated
- Checking to see that parameters and emission units are accurately recorded and that proper conversion factors are used
- Checking the conformity of databases and/or files
- Checking the consistency of data from one category to another
- Checking the accuracy of inventory data behavior from one processing step to the next
- Checking for completeness
- Checking time series consistency
- Checking trends
- Conducting comparisons with past estimated values

Description of uncertainties

Default activity data and emission factor uncertainty values applied to all categories and summarized in Table 39 were obtained from the IPCC Guidelines.

Table 2. 39: Summary of uncertainties for activity data and emission factors

2006 IPCC Categories	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
1.A.1.a.i - Electricity Generation	CO_2	5	6.14	7.92
	CH_4	5	228.79	228.84
	N_2O	5	228.79	228.84
1.A.2 - Manufacturing Industries and Construction	CO_2	5	5.00	7.07
	CH_4	5	5.00	7.07
	N_2O	5	5.00	7.07
	CO_2	5	4.17	6.51

2006 IPCC Categories	Gas	Activity Data Uncertainty (%)	Emission Factor Uncertainty (%)	Combined Uncertainty (%)
1.A.3.a.i - International Aviation (International Bunkers)	CH_4	5	100.00	100.12
	N_2O	5	150.00	150.08
1.A.3.a.ii - Domestic Aviation	CO_2	5	4.17	6.51
	CH_4	5	100.00	100.12
	N_2O	5	150.00	150.08
1.A.3.b - Road Transportation	CO_2	5	3.07	5.87
	CH_4	5	244.69	244.74
	N_2O	5	209.94	210.00
1.A.3.d.i - International water-borne navigation (International bunkers)	CO_2	5	4.30	6.60
	CH_4	5	50.00	50.25
	N_2O	5	140.00	140.09
1.A.3.d.ii - Domestic Water-borne Navigation	CO_2	5	4.30	6.60
	CH_4	5	50.00	50.25
	N_2O	5	140.00	140.09
1.A.4.a - Commercial/Institutional	CO_2	5	6.14	7.92
	CH_4	5	200.00	200.06
	N_2O	5	228.79	228.84
1.A.4.b - Residential	CO_2	5	6.14	7.92
	CH_4	5	200.00	200.06
	N_2O	5	236.36	236.42

Time series consistency issues

All the Activity Data used were obtained from SEYPEC. A group of experts applied the 2006 IPCC Guidelines to calculate the emissions from the whole time series and the selected emission factors.

Planned Improvements

- The data from 1990 to 1999 will be collected for all source categories to report the GHG emissions from aviation for the whole time series.

- A plan will be put into place to collect disaggregated data on energy consumed in MIC (1A2) to report emissions for the whole time series but disaggregated by industry type.

- Investigations will be done to explain the differences between the RA and SA.

- Uncertainties during the data collection process will be assessed.

Recalculations

Recalculations were done for the year 2000. CO_2 figures obtained from the SNC were compared to the recalculated figures in the TNC. Significant increases in the recalculated CO2 emissions were recorded for CO2 in the Manufacturing and Construction (47.47), Navigation, and Commercial and Institutional sectors. Recalculated CO_2 emission was lower in 2000 for Public Electricity Production (-7.17%) and International Aviation (-9.66%). The differences may be linked to the software version used compared to the 1996 version in the SNC.

Table 2. 40: 2000 Recalculations

	CO_2			CH_4			N_2O		
Categories	**Year (2000) -SNC**	**2000 Recalculated -TNC**	% Change	**Year (2000)**	**2000 Recalculate d**	% Change	**Year (2000)**	**2000 Recalculate d**	% Change
1. Energy (Fuel Combustion)	260.6 1	257.38	-1.24%	0.023 0	0.0284	23.54%	0.002 0	0.0044	118.36%
i) Public Electricity Production	147.1 5	136.60	-7.17%	0.005 9	0.0054	-8.35%	0.001 2	0.0010	-14.53%
ii) Manufacturin g & Construction	8.45	12.46	47.47%	0.000 2	0.0005	108.70%	0.000 1	9.6621	13802842.86 %
iii) Transport (Total)	66.00	66.96	1.46%	0.011 3	0.0174	53.90%	0.000 7	0.0029	321.18%
a) Road	50.73	50.77	0.07%	0.010 7	0.0165	53.35%	0.000 4	0.0025	472.47%
b) Navigation	7.98	8.92	11.69%	0.000 5	0.0008	71.43%	0.000 1	0.0002	381.26%
c) Aviation	7.28	7.28	-0.02%	0.000 1	5.0970	10193860.00 %	0.000 2	0.0002	-2.91%
iv) Commercial & Institutional	28.99	32.53	12.22%	0.004 2	0.0043	3.17%	0.000 3	0.0003	2.71%
v) Residential	8.78	8.82	0.47%	0.001 4	0.0009	-37.10%	0.000 1	3.1651	3956250.00%

	CO_2			CH_4			N_2O		
Categories	**Year (2000) -SNC**	**2000 Recalculated -TNC**	% Change	**Year (2000)**	**2000 Recalculated**	% Change	**Year (2000)**	**2000 Recalculated**	% Change
vi) Fishing	1.24		-100.00%	0.0001		-100.00%	0.0000		-100.00%
6. International Bunker									
i) Aviation	89.75	81.07	-9.66%						
ii) Marine	584.60	459.76	-21.36%						

2.16 Industrial Processes and Product Use (IPPU)

2.16.1 Sector Overview

The main activities contributing to greenhouse gas (GHG) emissions in the IPPU sector in Seychelles are ozone-depleting substitutes and the non-energy use of fuels. Food and beverage production is the leading industrial activity. The food industry in Seychelles comprises beer, meat and meat products, fish and fish products, poultry and poultry products, animal feed, and bakery.

In 2020, Seychelles' IPPU GHG emissions were dominated by Hydrofluorocarbons (HFCs) from the refrigeration and air conditioning (RAC) sector, with 21.63 gigagrammes of carbon dioxide equivalents (GgCO2eq), accounting for 95.08% of the emissions, followed by 1.058 Gg of carbon dioxide (CO2) from the non-energy products from fuels, with solvent use weighing in at 4.92%. Overall, the IPPU sector is a net source. A summary of the emission estimates in the IPPU sector is provided in Table 41 in GgCO2eq. The increase in GHG emissions in the sector from 2000 to 2020 was significant.

Table 2. 41: Overview of GHG emissions from IPPU in 2020 (Gg)

Categories	(Gg)			CO_2 Equivalents (Gg)						
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NOx	CO	NMVOCs	SO_2
2 - Industrial Processes and Product Use	1.058	0.00	0.00	21.63	0.00	0.00	0.00	0.00	0.00	0.00
2.A - Mineral Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Categories	(Gg)			CO_2 Equivalents (Gg)						
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NOx	CO	NMVOCs	SO_2
2.D - Non-Energy Products from Fuels and Solvent Use	1.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D.1 - Lubricant Use	1.37						0.00	0.00	0.00	0.00
2.D.2 - Paraffin Wax Use	0.01						0.00	0.00	0.00	0.00
2.D.3 - Solvent Use	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.D.4 - Other	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.00	0.00	0.00	21.63	0.00	0.00	0.00	0.00	0.00	0.00
2.F.1 - Refrigeration and Air Conditioning	0.00	0.00	0.00	20.36	0.00	0.00				
2.F.1.a - Refrigeration and Stationary Air Conditioning				6.59						
2.F.1.b - Mobile Air Conditioning				13.77						
2.F.2 - Foam Blowing Agents				0.00						
2.F.3 - Fire Protection				1.268	0.00					
2.F.4 - Aerosols				0.00						
2.F.5 - Solvents	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.F.6 - Other Applications										
2.G - Other Product Manufacture and Use	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H - Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.H.1 - Pulp and Paper Industry							0.00	0.00	0.00	0.00
2.H.2 - Food and Beverages Industry							0.00	0.00	0.00	0.00
2.H.3 - Other							0.00	0.00	0.00	0.00

The steady increase in Gross Domestic Product (GDP) from 2000 saw a rise in GHG emissions from the IPPU sector. The effect of such an increase can be observed in the trend depicted through this inventory, which indicates a significant rise in HFCs emissions. A major increase in hotel establishments and the service sector saw an increasing trend in the RAC sector since 2010. This led to a significant HFCs use for cooling in the tourism sector as ambient temperature rose (Figure 2-43).

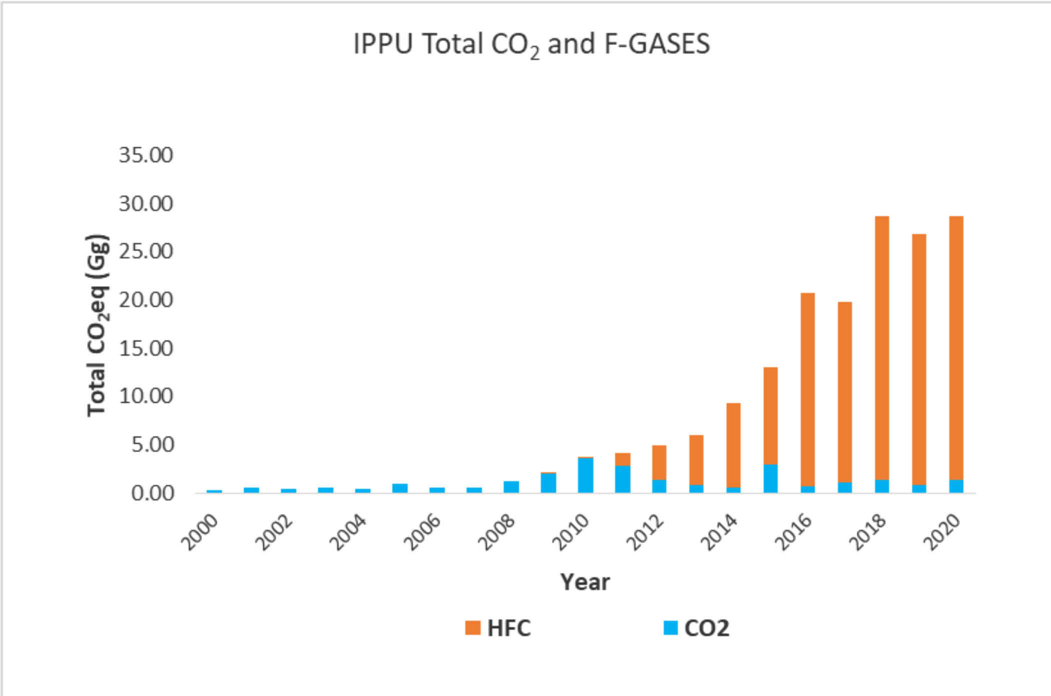


Figure 2-43: GHG emissions trends, 2000 to 2020

HFCs showed rising emissions, attributed mainly to increased use of the gases in air conditioning and refrigeration arising from an increase in tourism, residential, and commercial building sectors.

2.16.2 Methodologies and Completeness

The following categories are included in the inventory emission/removal estimates:

2. D - Non-Energy Products from Fuels and Solvent Use

- Lubricant Use (IPCC Category 2.D.1)
- Paraffin Wax Use (IPCC Category 2.D.2)
- Other - Asphalt Road Surfacing (IPCC Category 2.D.4)

2. F - Product Uses as Substitutes for Ozone Depleting Substances

- Refrigeration and Air Conditioning (IPCC Category 2.F.1)
- Fire Protection (IPCC Category 2.F.3)

2. H - Other

o Food and Beverages Industry (IPCC Category 2.H.2)

The following categories occur in Seychelles but are not covered in the inventory due to a lack of data:

- 2.D.3 - Solvent Use
- 2.F.5 - Solvents

The following categories were excluded from the inventory since they do not occur in Seychelles:

- 2.A - Mineral Industry
- 2.B - Chemical Industry
- 2.C - Metal Industry
- 2.E - Electronics Industry
- 2.G - Other Product Manufacture and Use

Efforts to acquire relevant data from sub-categories were futile, with most unavailable data. Some data were aggregated with various other items. With improvements in data collection, these categories can be reported in future inventories. Improvements in data collection are also crucial to ensure the use of higher-tier methodology for all years to improve emission calculations, particularly for Lubricant use, Paraffin wax used, and RAC.

GHG emissions from IPPU were estimated using Tier 1 approaches for all sub-categories.

Table 2. 42: Overview of methodologies and completeness

Categories	(Gg)			CO_2 Equivalents (Gg)			Gg			
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NOx	CO	NMVOCs	SO_2
2 - Industrial Processes and Product Use	T1	T1	T1	T1	T1	T1	T1	T1	T1	T1
2.A - Mineral Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.B - Chemical Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C - Metal Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D - Non-Energy Products from Fuels and Solvent Use	1.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2.D.1 - Lubricant Use	T1						0.00	0.00	0.00	0.00

Categories	(Gg)			CO_2 Equivalents (Gg)			Gg			
	CO_2	CH_4	N_2O	HFCs	PFCs	SF_6	NOx	CO	NMVOCs	SO_2
2.D.2 - Paraffin Wax Use	T1						0.00	0.00	0.00	0.00
2.D.3 - Solvent Use	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
2.D.4 - Other	0.00						0.00	0.00	0.00	0.00
2.E - Electronics Industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F - Product Uses as Substitutes for Ozone Depleting Substances	0.00	0.00	0.00	T1	0.00	0.00	NA	NA	NA	NA
2.F.1 - Refrigeration and Air Conditioning	0.00	0.00	0.00	T1	0.00	0.00	NA	NA	NA	NA
2.F.1.a - Refrigeration and Stationary Air Conditioning				T1			NA	NA	NA	NA
2.F.1.b - Mobile Air Conditioning				T1			NA	NA	NA	NA
2.F.2 - Foam Blowing Agents				T1			NA	NA	NA	NA
2.F.3 - Fire Protection				T1	0.00		NA	NA	NA	NA
2.F.4 - Aerosols				0.00			NA	NA	NA	NA
2.F.5 - Solvents				0.00	0.00		NA	NA	NA	NA
2.F.6 - Other Applications (please specify)				0.00	0.00		NA	NA	NA	NA
2.G - Other Product Manufacture and Use	0.00	NA	NA	NA	NA	NA	T1	T1	T1	T1
2.H - Other	0.00	NA	NA	NA	NA	NA	T1	T1	T1	T1
2.H.1 - Pulp and Paper Industry							T1	T1	T1	T1
2.H.2 - Food and Beverages Industry	0.00						T1	T1	T1	T1
2.H.3 - Other							T1	T1	T1	T1

2.16.2.1 Total GHG emission from IPPU in 2020 in CO2eq

The Seychelles' IPPU Sector emissions were mainly from Lubricant Use, Paraffin Wax Use, and RAC. The RAC category was the major contributor to GHGs in 2020. CO_2 emissions were calculated from the Non-Energy Products from the Fuels and Solvent Use sub-category. HFCs were calculated from the RAC sub-category

2.16.2.2 Percentage share of GHG emissions by gas (2020)

Few sub-categories in this sector emitted GHGs. The total GHG emission for this sector was 28.71 Gg CO2eq in 2020, as shown in Figure 2-44. The Non-energy products from fuels and solvent use and HFCs are the only sources of GHG emissions reported in this sector. Mobile air conditioning (2. F.1.a) contributed the most significant number of emissions, with 62.28%, followed by RAC, accounting for 28.98%.

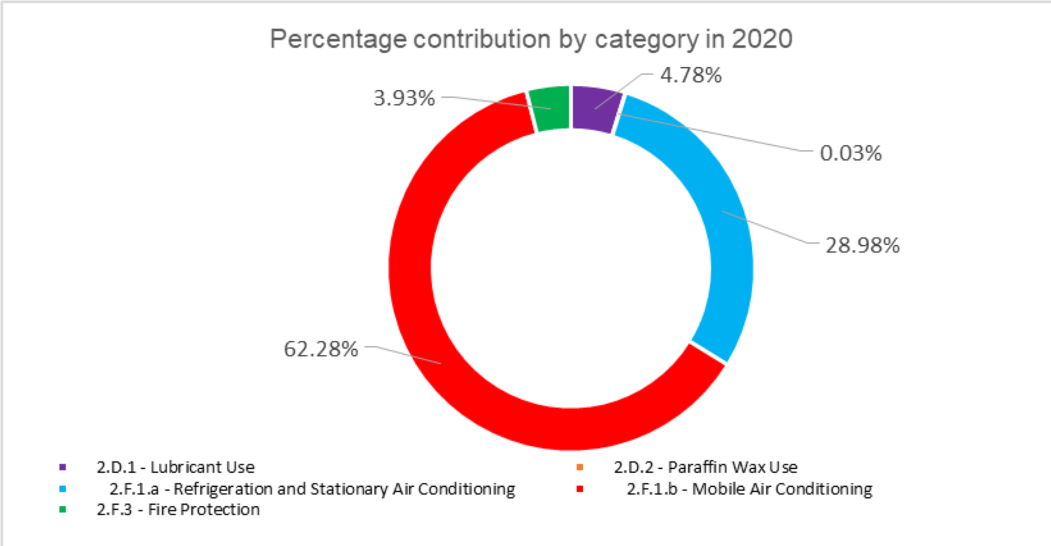


Figure 2-44: Percentage share of GHG emissions by source category (2020)

Table 2. 43: Summary of emission by gases as per Seychelles national communication

Greenhouse Gas Source & Sink Categories	Greenhouse Gas	Year (1995)	Year (2000)	Year (2010)	Year (2020)
2.D - Non-Energy Products from Fuels and Solvent Use	CO_2	NE	NE (0.381)	3.683	1.058
2.F - Product Uses as Substitutes for Ozone Depleting Substances	HFC	NE	0.00	0.063	8.4767
2.H - Other	NMVOC	NE	0.051	90.1393	134.345

HFC emissions from Products used as a substitute for the Ozone-depleting substances category (2F) became the most important GHG in the IPPU inventory in 2015, reflected by a sharp increase in emissions. From 2000 to 2011, emissions from HFC were not recorded. The trend in CO2 emissions for non-energy products from fuels and solvent use (2D) was inconsistent throughout the time series. The highest emissions were recorded in 2010 at 3.68 Gg CO2e, and the lowest recorded emissions were 0.38 GgCO2 in 2000 (Figure 2-45).

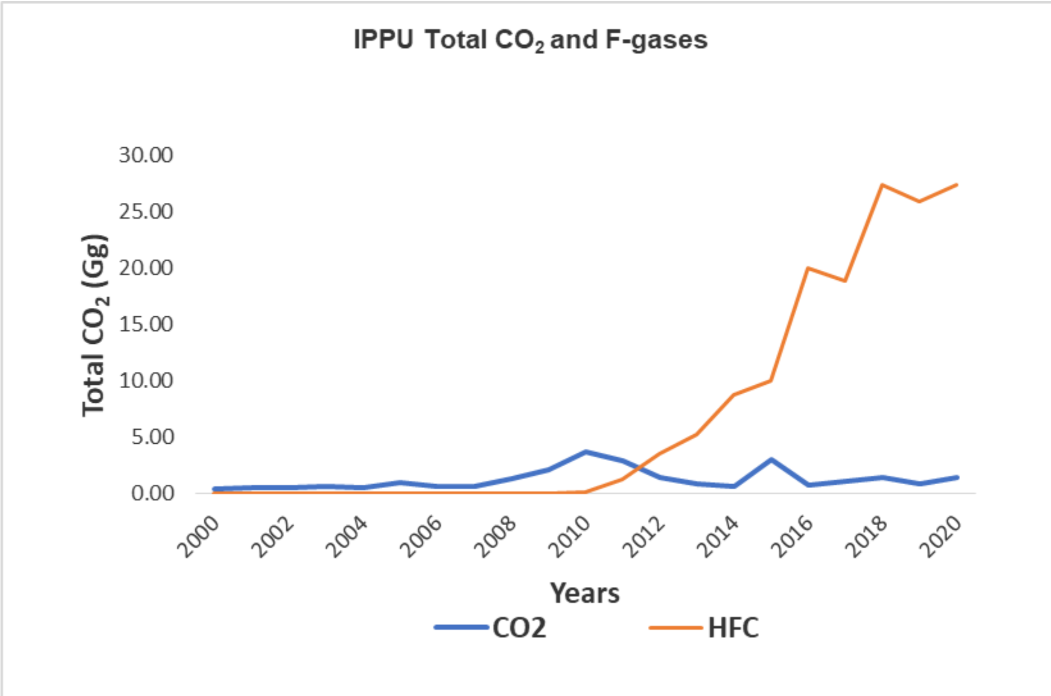


Figure 2-45: Trend in CO2 emissions for non-energy products from fuels and solvent use (2D) and HFCs Emissions from Product Uses as Substitutes to ODS (2F) categories of the IPPU sector (2000 to 2020)

2.16.2.3 GHG emissions by source category

Non-Energy Products from Fuels and Solvent Use (2D)

This category covers CO2 emissions from using non-energy products from fuels and solvents.

Lubricant use (2D1)

Description of sub-category

Lubricants are primarily used in industrial and transport applications to reduce friction in machinery parts and protect internal combustion engines in motor vehicles and powered equipment. Lubrication helps to minimize friction, surface fatigue, heat generation, noise, and vibrations. Lubricants are produced at refineries through separation from crude oil or at petrochemical facilities.

Lubricating oils, heat transfer oils, cutting oils, and greases

Seychelles imports lubricants since it does not produce these products. CO_2 is emitted from lubricants and greases during use. The lubricant use emissions from this sub-category fluctuated over the whole time series from 2000 to 2020 (Figure 57). The highest emissions were recorded in 2010 (3.49 GgCO2), followed by 2015 (3.00 GgCO2), whereas the year 2000 had the least emissions (0.38 GgCO2) (Figure 2-46).

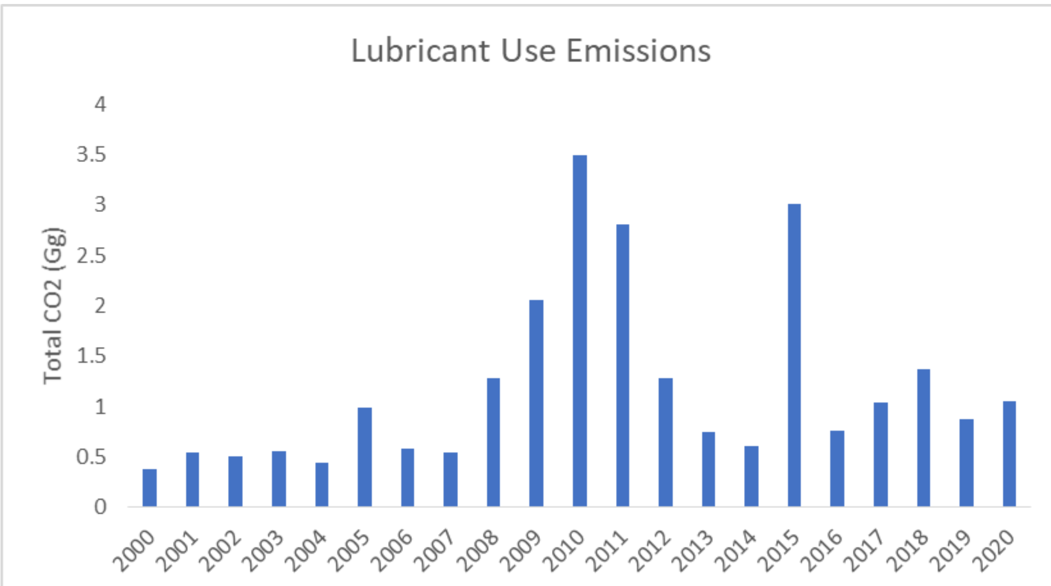


Figure 2-46: Emissions from Lubricant use

a. Method description

Tier 1 methodology was used to calculate CO_2 emissions, following Equation 5.2, per Figure 5.2 decision tree for estimating CO_2 emissions from non-energy uses of lubricants, section 5.2.2.1 of Volume 3 Chapter 5 of the 2006 IPCC Guidelines.

b. Activity data

Table 44 presents data on Lubricant use from 2000 to 2020. The data were obtained from the National Bureau of Statistics (NBS) and the Seychelles Revenue Commission's (SRC) import office.

Table 2. 44: Lubricant use data (TJ)

2000		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
25.704		37.258	34.134	37.990	29.594	67.634	39.241	37.073	86.200	136.634	234.571

0.009			0.978	1.111	0.894	0.292	0.000	0.000	2.931	14.376	13.266

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
187.991	85.486	1249.624	41.048	203.867	50.936	70.339	93.526	59.066	71.564
14.855	6.493	5.383	0.512	5.026	2.798	2.193	0.468	1.616	1.482

Source: NBS and the import office of the Seychelles Revenue Commission.

c. Emission factors

Default emission factors obtained from the IPCC Guidelines Volume 2, Chapter 1 in Table 2.1 were used owing to the lack of country-specific emission factors.

Table 2. 45: Emission factors for Lubricant use

Emission factor	Value	Source
ODU Factor	0,2	2006 IPCC GLs Default
Net calorific value for wax (TJ/Gg)	40.3	2006 IPCC GLs Default Volume 2, Table 1.2 Chapter 1

d. Description of uncertainties

For the uncertainty of activity data and EFs, default values of 10% and 0% were used, respectively, obtained from the 2006 IPCC Guidelines.

2.16.3 Activity Data Quality assurance and quality control

NBS undertakes quality control of their data as a routine task. Importation and trade data are quality controlled as mentioned below:

• Merchandise trade data is generated from the ASYCUDA World System from the Customs Department of the SRC.

• The Department of Information, Communication, and Technology (DICT) provides the data electronically to the NBS every month.

• The data are received in text format and uploaded to an Excel file to facilitate checking, analysis, and compilation of statistical tables.

Plots of data series and investigation of outliers, along with double checking with NBS on any inconsistencies, were undertaken.

a. Time series consistency issues

For activity data, the same sources, NBS and the import office of the SRC, were used throughout the time series.

b. Recalculations

Recalculations for this sub-category were not done due to the unavailability of data from previous inventories.

c. Improvements

Collecting disaggregated data for the lubricant and paraffin wax use category at the facility level can assist in improving the quality of emission estimation.

There is a need to include other gases, and precursors can be included in new inventory, for example, SF6 in the electricity transmission by PUC, but no data records are available.

Data classification is needed at the import office to facilitate data extraction for nitrous dioxide (NO2) uses in aerosols and other propellant products.

2.16.4 Paraffin wax use (2D2)

This category includes petroleum jelly, paraffin waxes, and other waxes. Paraffin waxes are separated from crude oil during light (distillate) lubricating oil production.

Paraffin wax use emissions for Seychelles followed an uneven trend over the entire time series (Figure 2-47). The peak was reached in 2010 with 0.195 Gg CO2 emissions, which had a significant difference from other years. The year 2014 recorded the least emissions at 0.002 GgCO2.

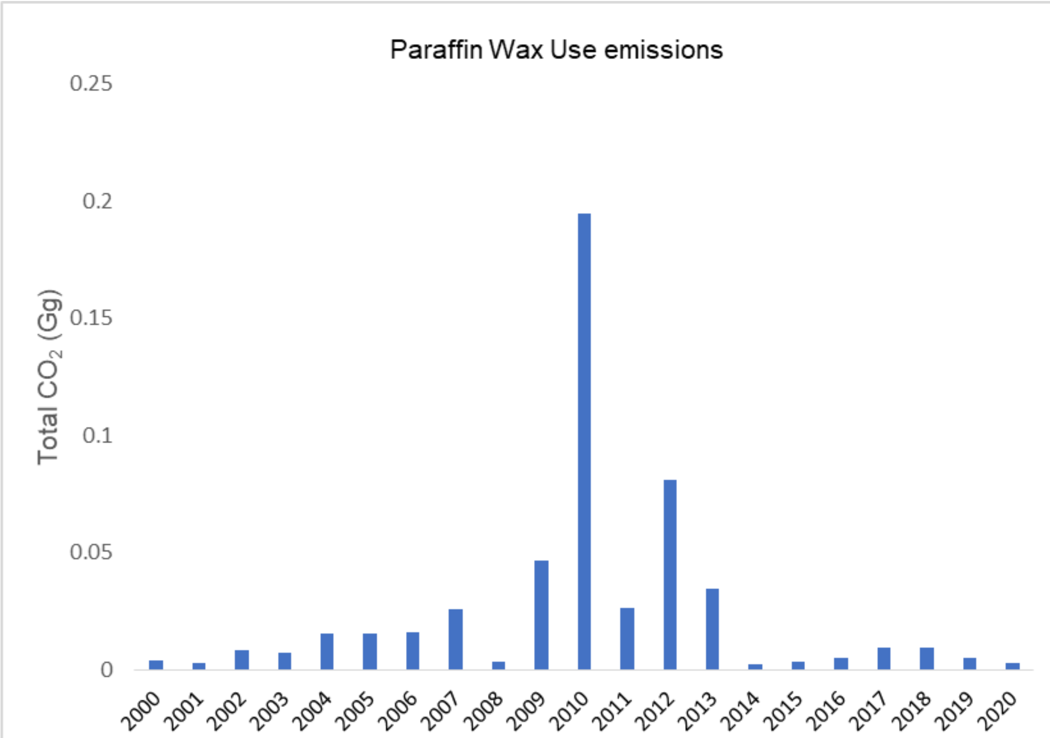


Figure 2-47: Paraffin Wax Emissions

a. Method description

The Tier 1 methodology was used, following the Figure 5.3 decision tree for estimating CO2 emissions from non-energy uses of paraffin waxes, in section 5.3.2.1 of Volume 3 Chapter 5 of the 2006 IPCC Guidelines. CO2 emissions were calculated according to Equation 5.4 with aggregated default data for the limited parameters available.

b. Activity data

Table 46 presents Activity data for paraffin wax use from 2000 to 2020. The data were obtained from Industry and Customs.

Table 2. 46: Paraffin Wax use (TJ)

2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0.277	0.210	0.573	0.496	1.063	1.066	1.080	1.771	0.250	3.169	13.259

2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1.821	5.533	2.346	0.154	0.234	0.350	0.664	0.633	0.351	0.189

Source: Industry and Customs Department

c. Emission factors

The default ODU factor of 0.2, obtained from the 2006 IPCC Guidelines, was applied. The calorific value used was 40.2 TJ/Gg, obtained from Table 1.3 in the 2006 IPCC Guidelines, Volume 2.

d. Description of uncertainties

Default uncertainties of 10% from the IPCC Software Version 2.691 were used.

e. Recalculations

Recalculations for this sub-category were not done due to the unavailability of data from previous inventories.

2.16.5 Solvent Use 2D3

This category was not considered only 2D4 specifying asphalt as the fuel for road data was not available.

2.16.5.1 Refrigeration and Air Conditioning-2F1

This category covers HFC and Perfluorocarbons (PFC) emissions from products that are substitutes for ozone-depleting substances (ODS) in refrigeration and air conditioning. The emissions from using products that are substitutes for ODS in refrigeration and air conditioning increased over the whole time series from 2009 to 2020 (Figure 59). There were sharp increases in the years 2016 and 2018, with 2009 recording the least emissions at 0.02 Gg HFCs, compared to 10.07 Gg HFCs in 2020 (Figure 2-48).

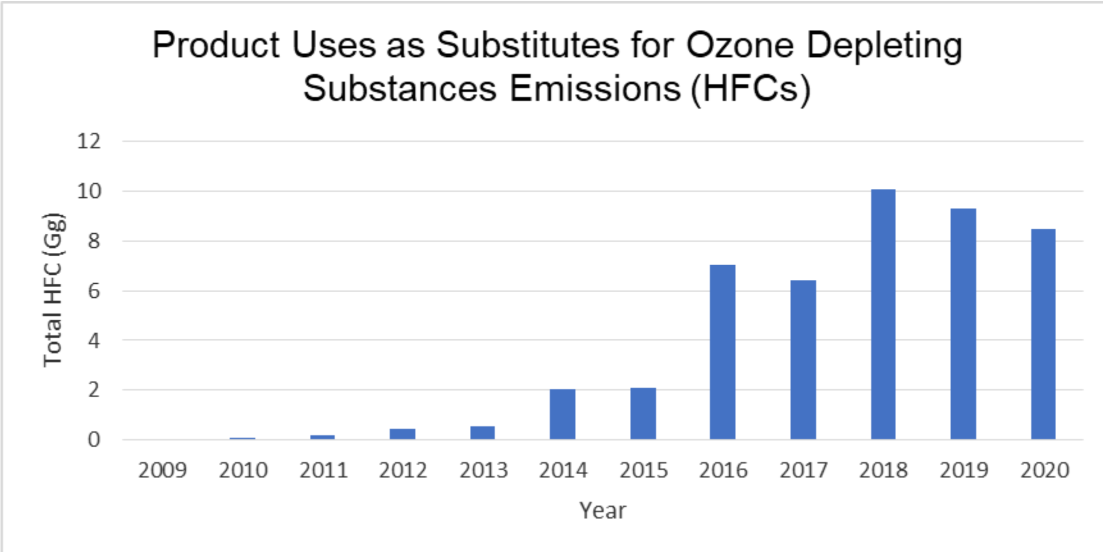


Figure 2-48: Use of the products that are substitutes for ODS in RAC

a. Method description

The Tier 1 methodology for aggregated data was used per section 7.5.2.1 of Volume 3, Chapter 7 of the 2006 IPCC Guidelines. The decision tree in Figure 7.6 for estimating emissions from Refrigeration and air conditioning and Table 7.2 were applied.

b. Activity data

Activity data were obtained from the NBS and the Customs Department of the SRC.

Table 2. 47: Chlorofluorocarbons data (mt)

	CFC-11	CFC-12	CFC-115 (505)
1987	0.89	1.48	0.21
1988	0.718	0.927	0.31
1989	0.599	0.315	0.429
1990	0.389	1.219	1.773
1991	0.41	2.54	1.09
1992	0.79	2.297	1.66
1993	0.27	8.1	3.24
1994	0	2.297	1.15
1995	0	3.146	1.232
1996	1.08	1.108	0
1997	0.84	1.63	0
1998	0	1.86	0.16
1999	0	1.088	0.067
2000	0	0.84	0

2001	0	1.5	0
2002	0	0.82	0
2003	0	0.57	0
2004	0	0.04	0

Table 2. 48: HCFC-22 (CHF2Cl)-Data (mt)

	HCFC-22
1994	2.25
1995	2.539
1996	2.911
1997	8.16
1998	12.78
1999	8.704
2000	1.23
2001	2.5
2002	2.99
2003	8.9
2004	8.42
2005	6.34

Table 2. 49: Halons - Halon- 1211 (CF2BrCl) (mt)

1987	0.151
1988	0.15
1989	0.163
1990	0.25
1991	0.276
1992	0.276
1993	0.296

Source: The Customs Department and the NBS.

c. Emission factors

A composite emission factor is required to complete a Tier 1 method. The over-arching default emissions factor of 15 percent of the bank annually was obtained from Section 7.5.2.2 of Volume 3, Chapter 7 of the 2006 IPCC Guidelines.

d. Quality assurance and quality control

- NBS undertakes quality control of its data as a routine task. Importation and trade data are quality controlled as mentioned below:

- Merchandise trade data are generated from the ASYCUDA World System from the Customs Department of the SRC.
- The DICT provides the data electronically to the NBS every month.
- The data are received in text format and are then uploaded in Excel to facilitate checking, analysis, and compilation of statistical tables.

e. Description of uncertainties

Default uncertainties from the IPCC Software Version 2.691 were applied.

f. Time series consistency issues

For activity data, the same sources, NBS and the import office of the SRC, were used throughout the time series.

g. Recalculations

Recalculations for this subcategory were not performed due to data unavailability.

2.16.5 Food and Beverages Industry -2H2

The GHG emissions reported under this category are non-methane volatile organic carbons (NMVOCs) from the production of Animal Feed, Beer, Canned Tuna, Poultry, Smoked fish, and Spirits. Generally, emissions from the Food and Beverages Industry fluctuated but had two peaks (Figure 2-49). There was a decrease from 2007 to 2012, which was attributed to the decline in Animal feed production over that period. Emissions from producing all other foods and beverages followed a steady growth over the whole time series. The year 2020 recorded the highest emissions of 134,086.64 Gg NMVOCs, compared to 74,000 NMVOCs (Gg) in 2012, which had the least emissions. This difference in emissions between 2012 and 2020 represented an increase of 80%. Canned Tuna contributed more than 60% of the total emissions from this sub-category.

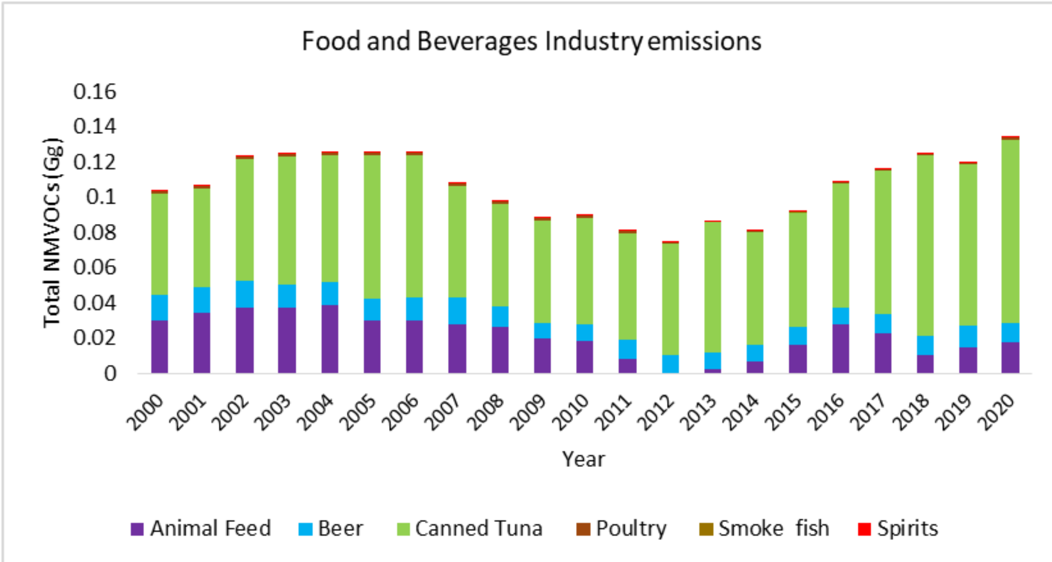


Figure 2-49: Emissions from Food and Beverages production

a. Method description

The Tier 1 approach for process emissions from the food and beverages industry was applied using annual national total food and beverages production. The Tier 1 emission factors assume an averaged or typical technology and abatement implementation in the country and integrate all different sub-processes in food and beverages production. The tier method followed Figure 3.1 decision tree for estimating NMVOCS emissions from the food and beverages industry, in section 3.1 of Volume 2-h-2 of the EMEP/EEA Guidebook of 2019. The experts calculated NMVOCS emissions according to the following general equation below:

$E_{pollutant} = AR_{production} * EF_{pollutant}$;

Equation 0-1: NMVOCS Food and beverages

This equation is applied nationally, using annual national total food and beverage production.

b. Activity data

Table 50 presents Activity Data for the Food and Beverages Industry from 2000 to 2020. The Activity data were obtained from the Customs Department of the SRC and the NBS.

Table 2. 50: Beverages Industry Activity Data

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010

Animal Feed (mt)	15148	17318	18565	18502	19417	15004	14821	13881	13053	10015	9053
Beer (mt)	7102.368	7298.928	7665.84	6571.152	6366.528	6313.104	6790.896	7566.048	6106.464	4251.744	4819.248
Canned Tuna (kg)	28781000	27789000	34503000	36436000	36109300	40606000	40222000	31569000	28907000	29110000	30338000
Poultry (kg)	734454	700380	675155	766196	750593	751360	817940	833320	768115	657783	550685
Smoked fish (kg)	12556	12556	14272	15689	15887	14783	25205	29413	30822	26566	29582
Spirits (mt)	0	0	0	0	0	0	585.97	740.00	1506.00	2445.58	2944.45

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Animal Feed (mt)	4088	0	1106	3436	8253	13753	11300	5018	7368	8860
Beer (mt)	5443.2	5338.368	4976.496	4488.624	5025.888	4716.432	5632.704	5696.208	6080.256	5349.456
Canned Tuna (kg)	30152000	31400000	36826000	32219000	32068440	35568700	40479964.07	51076847.33	45811766.39	52043321.69
Poultry (kg)	622303	251915	157393	221821	349521	315588	417001	398020.26	471110	628745
Smoked fish (kg)	29398	27688	40854	41013	57283	49880	27933	18010	22459	19477
Spirits (mt)	3484.32	3633.55	4766.95	4960.78	6334.29	5602.14	5078.17	3699.57	4015.54	2726.32

Source: The Customs Department and the NBS.

Table 2. 51: Emission Factors for food and beverages

Pollutant	Value	Unit
NMVOC	2	kg/Mg product produced

c. Quality assurance and quality control

- Merchandise trade data are generated from the ASYCUDA World System from the Customs Department of the Seychelles Revenue Commission (SRC).
- The DICT provides the data electronically to the NBS every month.
- The data are received in text format and are then uploaded in Excel to facilitate checking, analysis, and compilation of statistical tables.

d. Description of uncertainties

Uncertainties in the emissions from the production of food and beverages of 2 were obtained from the EMEP/EEA Guidebook 2019. All Tier 1 and Tier 2 emission factors in this Guidebook carry a 95% confidence interval.

e. Time series consistency issues

For activity data, the same sources from the NBS and the import office of the SRC were used throughout the time series.

2.17 AFOLU

2.17.1 AFOLU sector description

Seychelles' AFOLU GHG profile is dominated by emissions/removals from Forestry and Other land-use change and forestry (FOLU), followed by Agriculture. Overall, the AFOLU sector is a reducing net sink. The AFOLU sector is influenced mainly by the net removal of carbon by the forestry land. Emissions arise predominantly from the agricultural sector, followed by land conversion/land-use change from Forest land to Settlements. Smallholders' family farming system dominates agricultural production. According to the World Bank, this contributed to 1.8% of the country's gross domestic product (GDP) (The World Bank, 2020).

Most of the food consumed locally is through importation. In 2019 alone, food imports comprised more than 85% of the total locally consumed (NBS, 2019). According to the World Bank, Seychelles' food importation in 2020 was estimated to be above USD 100 million. Most of the domestic agricultural production continues to be severely impacted by the level of food imports, and, therefore, this has led to a reduction in national food production. Despite the negative impact of food imports, there is still a resilient group of local farmers who continue to supply the local market, which is helping the country minimize its dependence on imported foods. The sector, though small, has proven to be highly resilient and valuable by ensuring a constant supply of fresh fruits and vegetables during the first year of the COVID-19 pandemic in Seychelles.

According to the Seychelles' Ministry of Employment, the agricultural sector has the potential to employ more than 10% of Seychellois currently in the employment market (MoESA, 2020). However, due to the economic and demographic profile of the country, the sector employs more than 75% of foreign workers today, mainly from Bangladesh. According to the Department of Agriculture, the agricultural sector comprises crop production, livestock, fisheries, and forestry sub-sectors. Seychelles has a variety of fruits, leafy vegetables, tree crops, roots, and tubers that are adaptable to the country's three prominent soil types and climatic conditions. Crop production is the dominant sub-sector within agriculture, and it is a mixture of horticultural crops produced by small-scale farmers, followed by livestock.

Through the then Seychelles Agricultural Agency (SAA), the country in 2015 introduced the Seychelles National Agriculture Investment Plan (SNAIP). The development of this plan was achieved through the Comprehensive Africa Agriculture Development Programme (CCADAP) framework following intensive consultation with stakeholders from the agricultural sector (Ministry of Fisheries and Agriculture, 2015). The aim was to initiate a transformation of the national agricultural sector by investing in the critical areas of the sector, such as infrastructure, education, products, and value chain. However, seven years after the introduction of the SNAIP, there has not been much progress made to transform the sector due to changes in economic policy, which focuses more on the tourism sector.

In that regard, there has been a continuous decline in agricultural production and a steady increase in food imports. In practice, this meant that the agricultural sector was seriously lagging when agriculture was compared to the other economic sectors in Seychelles. In 2018, the World Bank estimated that the agricultural sector contributed 2.03% to Seychelles' GDP compared to 2.83% in the base year of 2000 (The World Bank, 2020). With a total land mass of just over 450 km2, land used for agricultural purposes is limited, thus confining many agricultural activities to small-scale domestic use. The steady decline in that sector's GDP contribution also meant a decline in GHG contribution from the agricultural sector. The effect of such a decline can be observed in the trend analysis conducted through this inventory, which indicates a decline in the emissions of CH4 and CO2. The observed decline is not because of ineffective agricultural management practices but because of the change in policy, decline in investment,, and failure of policy to support national agricultural development.

Land tenure in Seychelles is governed by the Cap 35 of the Seychelles' Law (Clarification of Titles to Land (Deeds of Concession) Act 1961, amended in 2012) (Government of Seychelles, 1961a). This act ensures the legal ownership of land, which may include forest areas by individuals (Seychelles' citizens) as a guarantee by the Constitution of The Republic of Seychelles. Therefore, forests in Seychelles can have the following ownership: Privately owned forest area as part of Land owned under Cap 35 of Seychelles' Law or State-owned land. All forests in Seychelles are considered managed.

Seychelles is a land of natural beauty, and the total land mass stretches over more than 45,220 km2, with one climatic zone and three soil conditions. According to the land use analysis carried out using Landsat Satellite Imagery as part of the development of the first FOLU inventory for Seychelles, forest areas remained relatively stable. Still, they were showing a gradual decline between 1990 -2020. In 1990, the total forest area was 40,096.19 ha; in 2000, the total forest area was 39,609.12 ha; and in 2020, the total forest area was 37,700.03 ha. The decrease in total forest areas between 1990 and 2020 is approximately 6.36%. The overall decline is driven mainly by the change in land use into settlements. At present, Seychelles is developing a National Forestry Policy, which aims to establish a better framework to manage forest resources in the future while driving investment in the sector to manage forest products better and generate employment in the sector. The finalization of the forest policy will facilitate a better assessment of how the forestry sector can contribute to the national economy and GDP.

This chapter includes greenhouse gas (GHG) emissions and removals from the AFOLU sector. The combination of the factors and implementation of national policies, available technologies, and management practices influence the emissions/removals from the AFOLU sector. The aggregate effects of how policies, technologies, and management practices are mainly used determine land-use practices and the associated emissions or removal of GHG from the AFOLU sector. Some of the practices include (a) livestock rearing (b) land-use change via forest conversion (deforestation), (c) afforestation, (d) wood fuel extraction, (e) wildfire disturbance (f) application of nitrogen-based fertilizers. The 2006 IPCC Guidelines divide the AFOLU sectoral activities into clusters of three emission/removal categories. The criteria for the clustering are based on whether the activity is land-based or non-land-based. Each category is further disaggregated into the activities contributing to emissions/removals. The three emission/removal categories clusters are livestock, land and aggregated sources, and non-CO_2 emission sources from land. The IPCC Guidelines assign unique codes for sectors, categories, sub-categories, and activities. The code for the AFOLU sector is prefixed with Figure 3 since it is the third in the sequence of IPCC inventory sectors. The three categories under the AFOLU sector and their codes are as follows: livestock (3A), land (3B), and aggregative and non-CO2 emission sources (3C). Based on the IPCC 2006 Guidelines (Eggleston et al., 2006), the following categories are included in the inventory emission/removal estimates:

- Livestock (Category 3A)
  - Enteric fermentation (IPCC Category 3A1)
  - Manure management (IPCC Category 3A2)
- Land (Category 3B)
  - Forest land (IPCC Category 3B1)
  - Cropland (IPCC Category 3B2)
  - Grassland (IPCC Category 3B3)
  - Wetlands (IPCC Category 3B4)
  - Settlements (IPCC Category 3B5)
  - Other lands (IPCC Category 3B6)
- Aggregate sources and non- CO2 emissions on land (Category 3C)

- o Biomass burning (IPCC Category 3C1)
- o Liming (IPPC Category 3C2)
- o Urea application (IPCC Category 3C3)
- o Direct N2O emission from managed soils (IPCC Category 3C4)
- o Indirect N2O emission from managed soils (IPCC Category 3C5)
- o Indirect N2O emission from manure management (IPCC Category 3C6)
- • Other (Category 3D)
- o Harvested wood products (IPCC Category 3D1)

Categories that form part of Seychelles' agricultural sector but were not included in this inventory report are rice cultivation (3C7), Biomass burning (IPCC Category 3C1), and Harvested wood products (IPCC Category 3D1), due to lack of data or activity data unavailability. With improvements, data on these categories can be incorporated into future inventories. Categories include Tier 1 approaches. Manure management consists of all emissions from confined, managed animal waste systems. Methane emissions from livestock manure produced in the field during grazing are included under manure management (3A2); however, the N2O emissions from this source are included under category 3C4, direct N2O emissions from managed soils, per the IPCC 2006 Guidelines. According to the guidelines, methane emissions from managed soils are considered non-anthropogenic and omitted.

2.17.2 Overall emission trends

2.17.2.1 AFOLU emissions in 2020

In 2020, the AFOLU sector was a net sink at a removal rate of -150.85 Gg CO2 equivalent. The current removal also represented a -45.82% decrease compared to the beginning of the 2000 inventory year, which was reported at -278.45 Gg CO2e (Figure 2-50). The reduction in the size of the sink relates to activities and management practices such as deforestation through forest conversions to settlement, emissions from livestock enteric fermentation, urea application, and nitrogen additions to soils. On a gas-by-gas basis, CO_2 had the more significant share of the AFOLU reported removals at -95%, whereas CH_4 and N_2O contributed to only 4% and 1%, respectively, of the total gas emissions in 2000 (Figure 2-51). In 2020, the reported removals were -94% CO2, representing a 1% reduction in removal capacity. The contributions from CH4 and N2O were 6% and 1%, respectively (Figure 2-52).

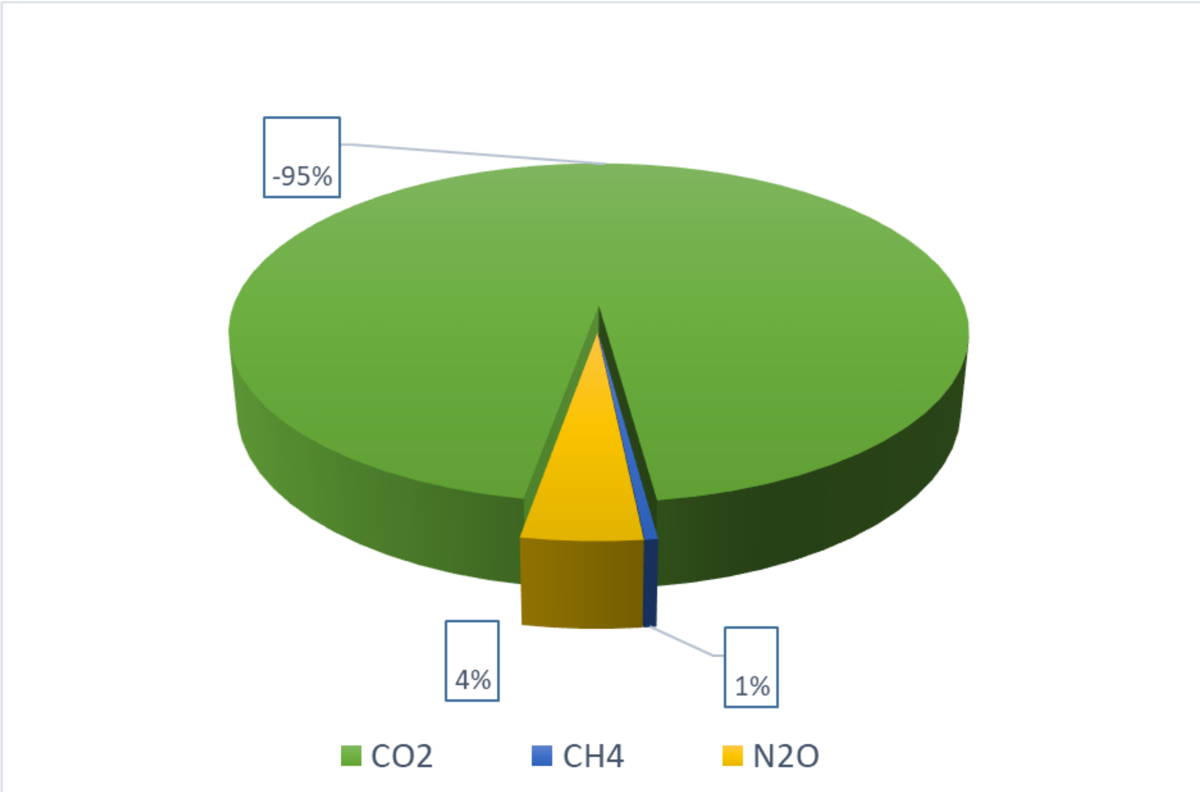


Figure 2-50: Summary of percent contribution by gas for Seychelles' AFOLU sector in 2000

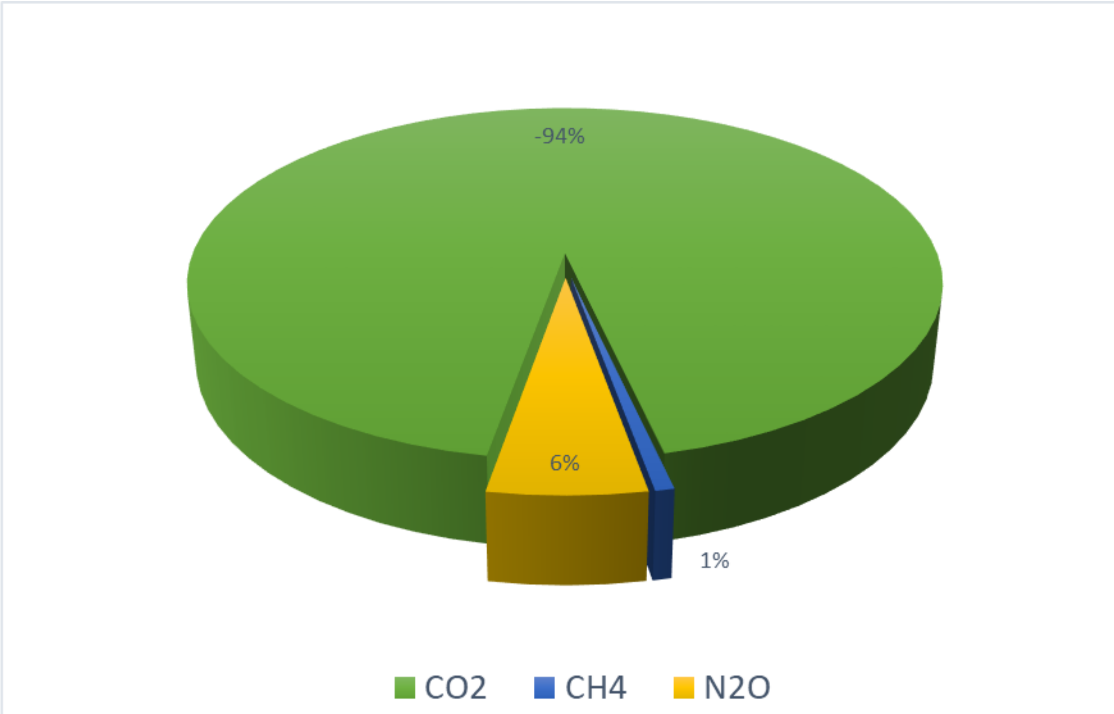


Figure 2-51: Summary of percent contribution by gas for the Seychelles' AFOLU sector in 2020

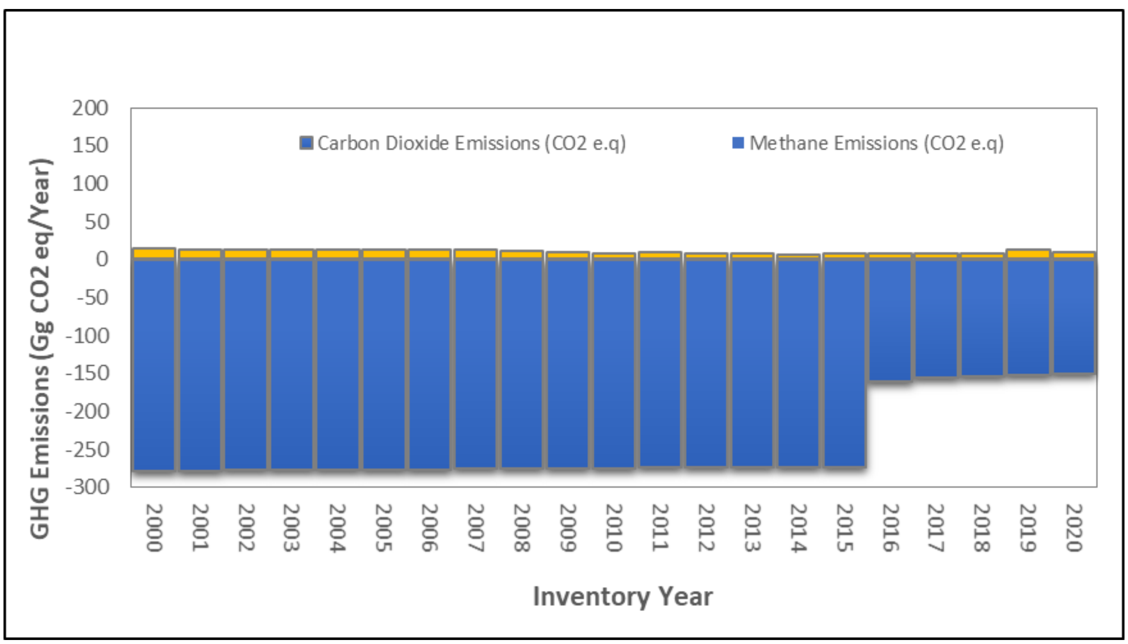


Figure 2-52: Summary of Emissions by gas for AFOLU the sector for Seychelles, 2000-2020

Within the AFOLU sector, forest land had the most considerable contribution at -65.8%, representing a net removal of CO_2. This was followed by emissions from settlements at 28.6%, cropland at 3.3%, emissions from soils, and direct N_2O from the managed soils category at 1.2%, followed by manure management at 0.3%. The remaining sources were shared, including indirect N_2O-managed soils, Urea application, enteric fermentation, and Liming (See Figure 2-53).

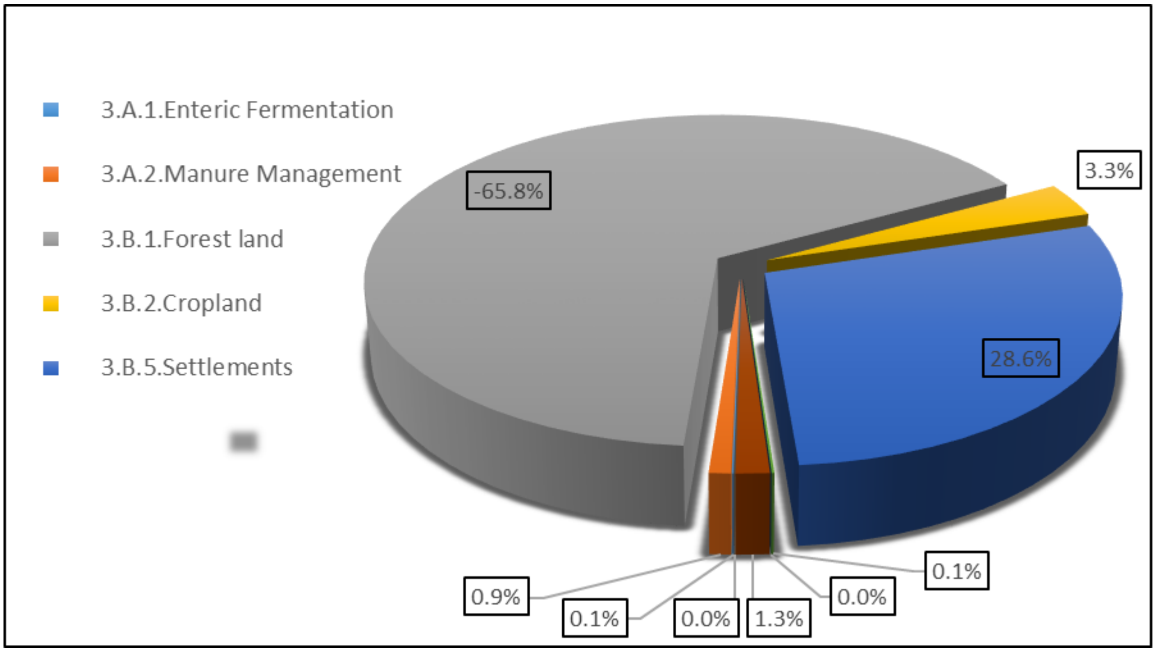


Figure 2-53: Summary of percent contribution of the AFOLU sector categories for Seychelles in 2020

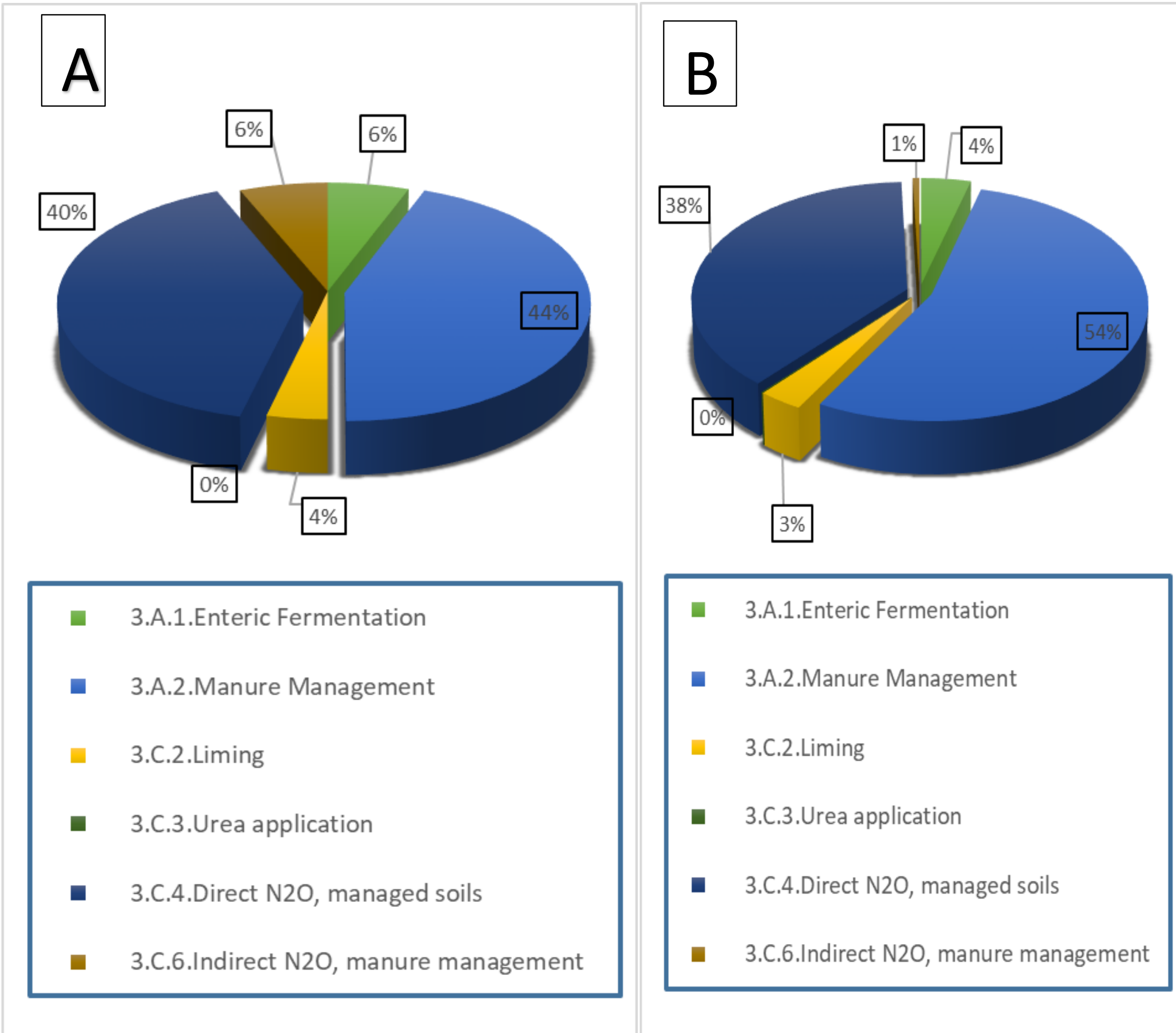


Figure 2-54: Summary of the estimated emissions from the Seychelles' agricultural components of the AFOLU sector in 2000 (2-53a) and 2020 (2-53b)

In 2020, the emissions from manure management were at 54% (3.84 Gg CO2e) (Figure 64. B), compared to 44% (1.301 Gg CO2e) in 2000 (Figure 2-54A). This represents a 2.54 Gg CO2e increase or a 66% increase compared to the base year. Emissions from direct N2O from the managed soils category remained a critical emission source for the AFOLU Sector at 38% (6.01 Gg CO2e) (Figure 2-54B), indicating a slight increase in emissions when compared to 2018, despite the proportion in N2O percentage being slightly larger (40%) in 2018 (Figure 64. A). Other sources of emission for 2020 were enteric fermentation at 4% (0.288 Gg CO2e), Indirect N2O at 1 % (0.084 Gg CO2e), liming at 3% (0.485 Gg CO2e), all contributing to the total agriculture emissions, with Urea application contributing less than 0.0% (Figure 2-53 A and B).

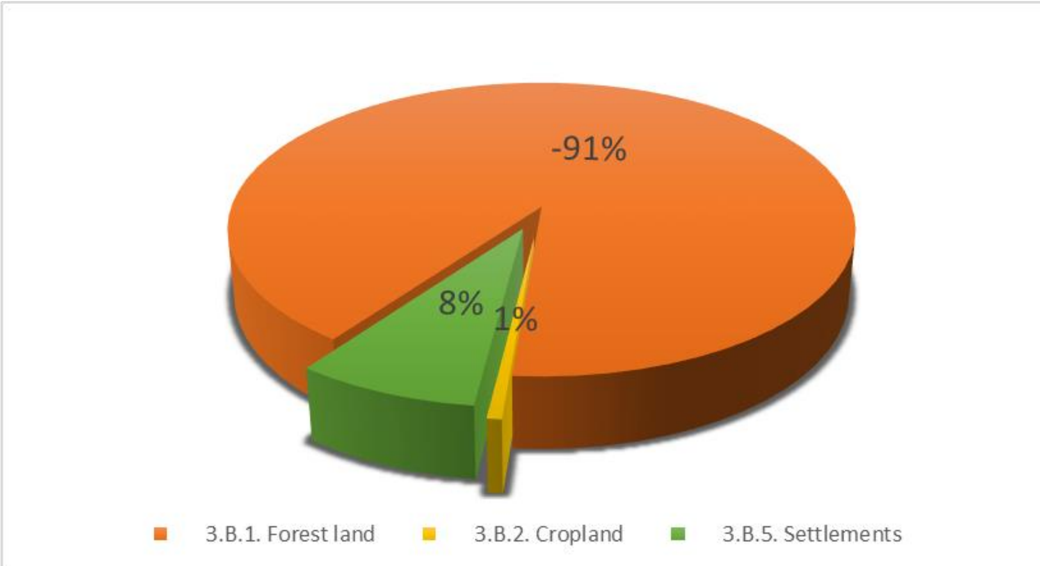


Figure 2-55: Summary of the estimated emissions from the Seychelles' Forestry and Other Land Use components of the AFOLU sector in 2000

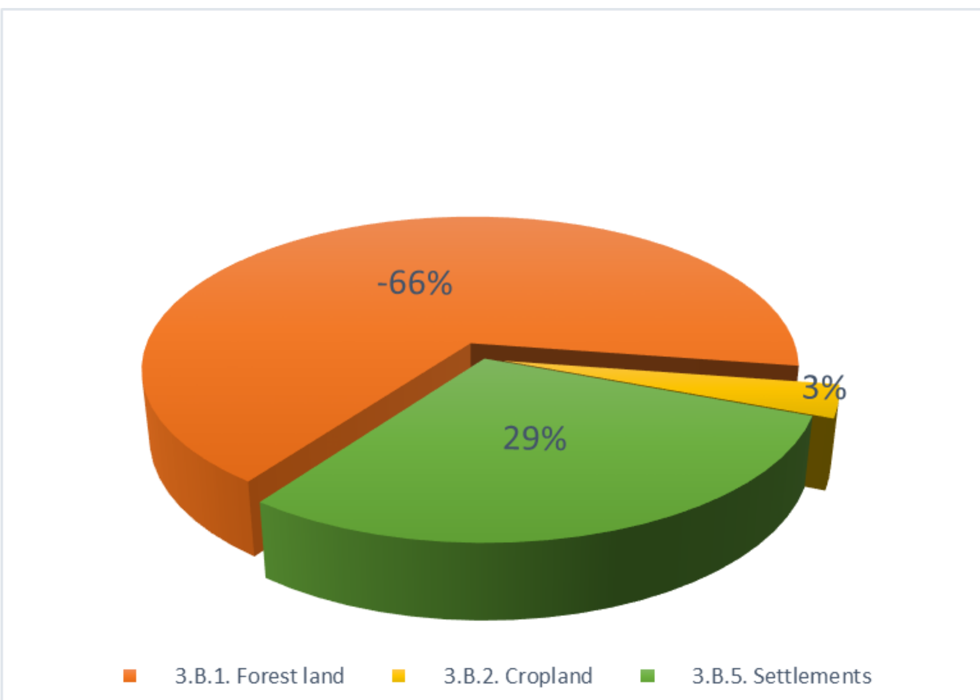


Figure 2-56: Summary of the estimated emissions from the Seychelles' Forestry and Other Land Use components of the AFOLU sector in 2020

A summary of the estimated emissions and removals for the forestry and other land use sector (FOLU) indicates that the Forestland in 2020 was a net removal, accounting for -66% (-293.5 Gg CO_2e) (Figure 2-55). However, compared to 2000, the net removal was 91% (-308.36. Gg CO_2e). This represented a decrease of 4.82% (7.7 Gg CO_2e) or an annual loss of 0.25% (0.64 Gg CO_2e) between the inventory years of 2000 and 2020 (Figure 2-56). In 2020, settlement was a net contributor with 29% emission (127.5 Gg CO_2e). This represented an increase of 369% (27.2 Gg CO_2e in 2000 and 100.3 Gg CO_2e in 2020). This represented an annual increase in emission of 8.4 Gg CO_2e or a percentage increase of 30%. In 2020, cropland contributed to 3% of the emissions (14.6 Gg CO_2e). This represented an increase in emission from 1% in 2000 (2.2 Gg CO_2e). While cropland was a net source at 2.19 Gg CO_2e in 2000 and 14.67 Gg CO_2e in 2020, this change represented a 568.67 % increase in emissions.

2.17.2.2 AFOLU emission trends between 2000 and 2020

Overall, the AFOLU sector was a decreasing net sink from 2000 at -264.08 Gg CO_2e to -147.21 Gg CO_2e in 2020. The emissions trend was driven mainly by emissions from land conversion from Forest land to Settlements under the 3B Category. A key driver of this change was the Land and housing policy, which aimed to ensure every Seychellois family had a decent house. Other housing programs, such as the 24 houses in 24 months and in 24 districts initiated by the former government administration in 2017exacerbated the issue. There was a gradual downward trend under the 3C categories, aggregated sources, and non-CO_2 emission sources from land at 12.2 Gg CO_2e in 2000 and 9.11 Gg CO_2e in 2020. This was mainly driven by changes in policy in the agricultural sector that led to a decreased area of agricultural land under cultivation as well as a decrease in livestock population as a result of increased meats and vegetable import that was driven by policies such as the Strategy 2012 – 2017, which hindered the development of commercial agriculture in favor of the tourism and infrastructure sectors.

The AFOLU Sector, including the LULUCF, represented net emissions in 2020 compared to 2000. However, the AFOLU Sector, excluding LULUCF, showed a downward trend from 2000 to 2020. However, the 2020 inventory showed an increase in emissions compared to the 2018 inventory, from 7.29 Gg CO_2e to 13.24 Gg CO_2e. The change in emissions in 2020 compared to 2018 was driven primarily by improvements made by the Department of Agriculture (DoA) to collect farm data. The COVID-19 pandemic was another driver for the increase in emissions in the AFOLU Section. This increase was mainly due to support provided to the livestock sector to increase the number of heads of livestock to cope with the shortage of imports during the pandemic, thus leading to an increase in local livestock production. Despite the rise in GHG emissions in 2020, the agricultural sector of Seychelles remained a minor contributor to emissions, translating that the sector had a decrease in emissions from 14.9 Gg CO_2e in 2000 to 13.24 Gg CO_2e in 2020. This indicated that overall, the AFOLU sector decreased its emissions by 10.85% (1.61 Gg CO_2e), hence manifesting a yearly decrease of emissions of 0.089 Gg CO_2e or 0.6% (Figure 2-57).

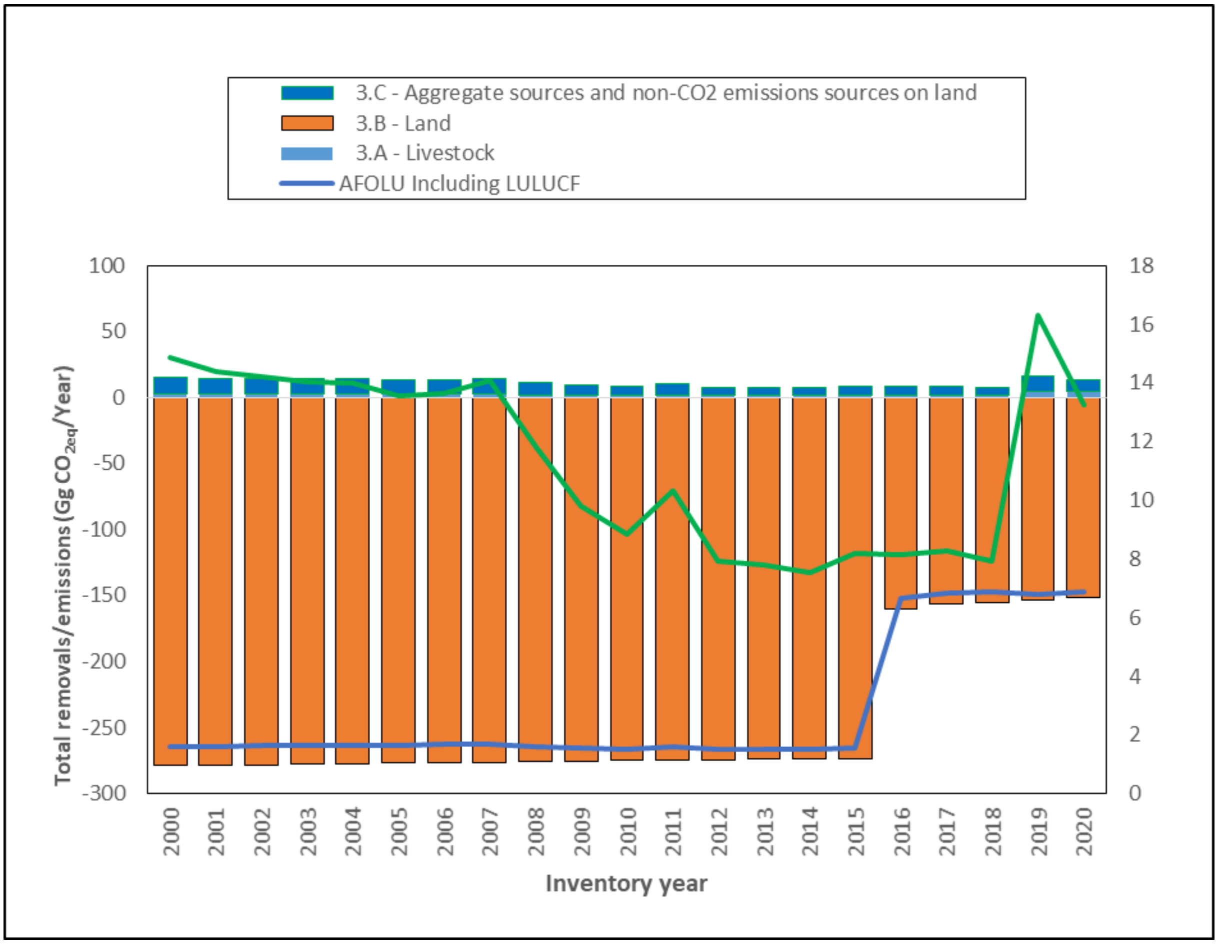


Figure 2-57: Trends in emissions and removals for the AFOLU sector in Seychelles between 2000 and 2020

2.17.2.3 Agriculture emission trends between 2000 and 2020

While the emissions fluctuated over the whole time, they nonetheless manifested a decreasing trend up to 2020. From 2019 to 2020, there was an increase in emissions. The emissions profile was dominated by direct N2O emissions from managed soils, with direct N2O emission at 10.4 Gg CO2e in 2000 and 6 Gg CO2e in 2020. This was followed by emissions from manure management, which were estimated to be at 2.4 Gg CO2e and 3.8 Gg CO2e in 2000 and 2020, respectively. Indirect N2O emission from manure management was estimated at 1.3 Gg CO2e in 2000, then decreased to 1.15 Gg CO2e in 2020. As explained earlier, the decrease between 2000 and 2018 was attributed mainly to changes in policy, which further led to a reduction in agricultural activity and, thus, a decline in emissions. However, as indicated above, the increase in emissions between 2018 and 2020 (Figure 2-58) was mainly due to a sudden increase in agricultural production during the COVID-19 pandemic to cope with the rise in demand for local agricultural produce. This increase in agricultural production allowed for more data to be collected by the Department of Agriculture on the number of heads of livestock slaughtered. This census exercise elucidated the fact that a higher livestock population was unaccounted for in the Seychelles. Therefore, a comprehensive census exercise on the number of livestock across Seychelles islands must be conducted during the next inventory.

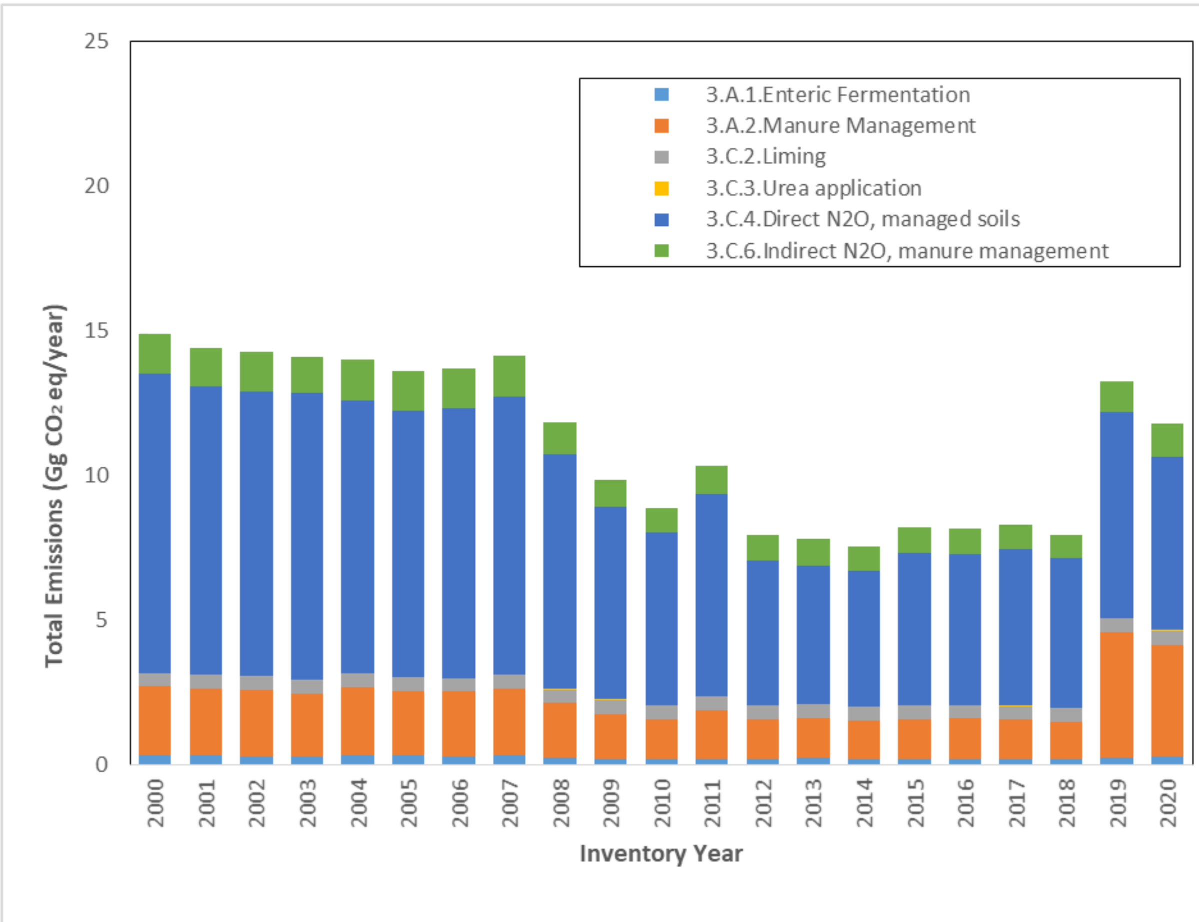


Figure 2-58: Emissions trends from Seychelles' agricultural components of the AFOLU sector between 2000 and 2020

2.17.3 Overview of methodology and completeness for the AFOLU Sector

Table 2-52 summarizes the methods and types of emission factors used during the compilation of the AFOLU 2020 inventory.

Table 2. 52: AFOLU methods and completeness

AFOLU Greenhouse Gas Source and Sink Categories	Gases Included	Key Categories	Tier/ Notation Key	Notes
3A Livestock				
3A1 Enteric fermentation	**CH_4**	**KC**	**NO/T1/**	
a.i. Dairy cattle	CH_4		NO	IPCC defaults emission factors - 2006 IPCC Guidelines
a.ii. Non Dairy cattle	CH_4		T1	
b. Buffalo	CH_4		NO	
c. Sheep	CH_4		NO	
d. Goats	CH_4		NO	
e. Camels	CH_4		NO	
f. Horses	CH_4		NO	
g. Mules and asses	CH_4		NO	
h. Swine	CH_4		T1	
3A2 Manure management	**CH_4, N_2O**	**KC**	**NO/T1**	
a.i. Dairy cattle	CH_4, N_20		NO	IPCC defaults emission factors-2006 IPCC Guidelines
a.ii. Non-Dairy cattle	CH_4, N_20		T1	
b. Buffalo	CH_4		NO	
c. Sheep	CH_4		NO	
d. Goats	CH_4		NO	
e. Camels	CH_4		NO	
f. Horses	CH_4		NO	
g. Mules and asses	CH_4		NO	
h. Swine	CH_4		T1	
i. Poultry	CH_4,N_20		T1	
3B Land				
3B1 Forest land	**CO_2**	**KC**	**T1**	
a. Forest land Remaining Forest land	CO_2		T1	Land use maps 2000, 2015,2020
b. Land Converted to Forest land	CO_2		T1	
3B2 Cropland	**CO_2**	**KC**	**T1**	
a. Cropland Remaining Cropland land	CO_2		T1	Land use maps 2000, 2015,2020
b. Land Converted to Cropland	CO_2		T1	
3B3 Grassland	**CO_2**	**KC**	**NO**	

AFOLU Greenhouse Gas Source and Sink Categories	Gases Included	Key Categories	Tier/ Notation Key	Notes
a. Grassland Remaining Grassland	CO_2		NO	Land use maps 2003, 2008,2013 - 2018
b. Land Converted to Grassland	CO_2		NO	
3B4 Wetland	**CO_2**	**KC**	**NE**	
a. Wetlands Remaining Wetlands	CO_2		NE	Land use maps 2003, 2008,2013 - 2018
b. Land Converted to Wetlands	CO_2		NE	
c. Peatlands	CO_2 N_20 and CH_4		NE	
3B5 Settlements	**CO_2**		**T1**	
a. Settlements Remaining Settlements	CO_2		T1	Land use maps 2003, 2008,2013 - 2018
b. Land Converted to Settlements	CO_2		T1	
3B6 Other land	**CO_2**		**NO**	
a. Other land Remaining Other land	CO_2		NO	Land use maps 2003, 2008,2013 - 2018
b. Land Converted to Other land	CO_2		NO	
3C Aggregated and non-CO_2 emissions on land				
3C1 Biomass burning	**CO_2, CH_4, N_20**		**NE**	
a. Forest land	CO_2, CH_4, N_20		T1	T1 emission factors from IPCC 2006 Guidelines
b. Cropland	CO_2, CH_4, N_20		T1	
c. Grassland	CO_2, CH_4, N_20		NO	
d. Wetland	CO_2, CH_4, N_20		NO	
e. Settlements	CO_2, CH_4, N_20		NO	
f. Other land	CO_2, CH_4, N_20		NO	
3C2 Liming	**CO_2**		**T1**	
3C3 Urea application	**CO_2**		**T1**	**T1 emission factors from IPCC 2006 Guidelines**
3C4 Direct N_2O emissions from managed soils	**N_2O**		**T1**	**T1 emission factors from IPCC 2006 Guidelines**
3C5 Indirect N_2O emissions from managed soils	**N_2O**		**T1**	**T1 emission factors from**

AFOLU Greenhouse Gas Source and Sink Categories	Gases Included	Key Categories	Tier/ Notation Key	Notes
				IPCC 2006 Guidelines
3C7 Rice cultivation			NO	
3D Other				
3D1 Harvested wood products	CO_2		NE	

Key of Abbreviations: T1 is Tier 1; NA is Not Applicable; NO is Not Occurring; NE is Occurring but Not Estimated

2.17.4 Improvements for the AFOLU sector since the 2015 submission of the SNC

The assessment of the AFOLU sector has undergone significant improvements since the submission of the SNC in 2011. The 1996 IPCC Guidelines were used in the previous inventory, and the agriculture and land sectors were treated as separate sectors. Significant assessment improvements have been made in this submission, and the 2006 IPCC Guidelines were used to compile the inventory. However, these improvements meant that it was impossible to perform recalculation for the 2018 inventory as the changes led to the two inventories being incomparable. Nonetheless, for the reporting of the 2020 BUR, since the same set of maps from the 2018 inventory was used with no further improvement, there was no rationale to conduct any recalculation. Significant changes that have been made to this sector included the following assessment improvements:

- Livestock Categories (3A): For most categories, country data on livestock population were used, with some FAO data used to fill the gap.

- Manure management data were adjusted to include revised manure management systems practiced in the country, the percentage emission contribution of which was established through expert judgment in some cases (including green manure from the farm).

- The average animal live weight was obtained from the Department of Agriculture.

- Complete overlay of GIS-based land cover/land use raster maps with soil, climate, and Eco region maps.

- A systematic land representation framework was developed for the forestry and land sector. GPS and drone data were used to enhance the accuracy of maps.

Note that to establish activity data, remote sensing and GIS analysis methods were applied in the FOLU part. Recalculations were not performed for the sector as the significant assessment improvements made the inventory not comparable to 2020 since the last inventory in the Second National Communication (NC2) only had agricultural components using the 1996 Guidelines with no LULUCF component.

2.17.5 Key categories in the AFOLU sector

A key category analysis (with a level and trend assessment) was completed for the AFOLU sector only, and the results are provided in Table 2-53.

Table 2. 53: AFOLU key categories determined by level (L1) and trend (T1) assessments

Greenhouse Gas Source and Sink Categories	Gas	Emissions/removal (Gg CO_2e)		Key category assessment type
		2000	2020	
Forest land Remaining Forest land	CO_2	-308.361	-293.497	L1, T1
Land Converted to Settlements	CO_2	27.234	127.489	L1, T1
Land Converted to Cropland	N_2O, CO_2	2.193	14.667	L1, T1
Direct N_2O from managed soils	N_2O	10.354	6.001	L1

2.17.6 Proposed improvements for the AFOLU sector

Data gaps in the AFOLU sector were considered, and a list of proposed improvements for consideration in future inventories or for data collection activities are provided in Table 2-54.

Table 2. 54: Proposed improvements for the AFOLU sector

Improvement Issue	Related to a key category	Effort required to carry out the task
	Yes/No	Low/High
Improve land cover classifications for 1990 and 2020 using improved remote sensing techniques and field data.	Yes	High
Disaggregate forest data by forest type to natural and plantation forests	Yes	High
Introduce age class data in plantations and natural forests	Yes	High

Include specific crop data and fallow croplands to move to a higher tier calculation for croplands.	Yes	High
Develop a system to collect livestock data from commercial and small-scale farms.	Yes	High
Improve data collection and reporting on the application of lime in agricultural areas /farms.	Yes	High
Develop a tool and platform for data collection on manure management	Yes	High
Undertake local studies to determine country-specific emission factors for the AFOLU sector, including biomass present on land for wetlands, and settlements.	Yes	Low
Collect data and establish a methodology for estimating emissions from biomass burning across all land uses.	Yes	High
Improve the recording of lime application and records keeping of import for lime.	Yes	High
Build capacity to perform uncertainty assessment.	Yes	High

2.18 Emissions and removals from Livestock category (3A)

2.18.1 Category Overview

Livestock emissions in Seychelles between 2000 (2.681 Gg CO2e) and 2020 (4.132 Gg CO2e) generally showed a downward trend, with a notable sharp decrease recorded between 2007 and 2010 (Figure 2-59). However, there was a sharp increase between 2018 and 2019, with a slight decline in 2020. This represented a 54.12% increase in emissions across the time series from 2000 to 2020. The country recorded the highest emissions from both enteric fermentation and manure management between 2000 and 2007, and this decline continued across the time series until 2018. There was a slight increase in emissions between 2018 and 2019, with a slight decrease in 2020. A plausible reason for the reduction in emissions is likely the low expansion in livestock production across the country due to the massive importation of livestock products at lower prices. For example, pig production decreased by 37%, moving from 8619 heads in 2000 to 5414 heads in 2018. For cattle production, the population was 147 heads in 2000 to 45 heads in 2018, a decrease of 69% (NBS, 2021). Two more economic factors that contributed to the decline of livestock production were as follows. Firstly, it was the 2008 financial crisis. The second was the liberalization of the importation of meat produce with the view that the average consumer would benefit from cheaper meat products. However, this created intense competition, forcing many local livestock farmers to close their livestock businesses and production units (Table 2-55). The slight increase in livestock production recorded in 2019 was attributed to a sudden change in government strategy to increase local production during the COVID-19 pandemic.

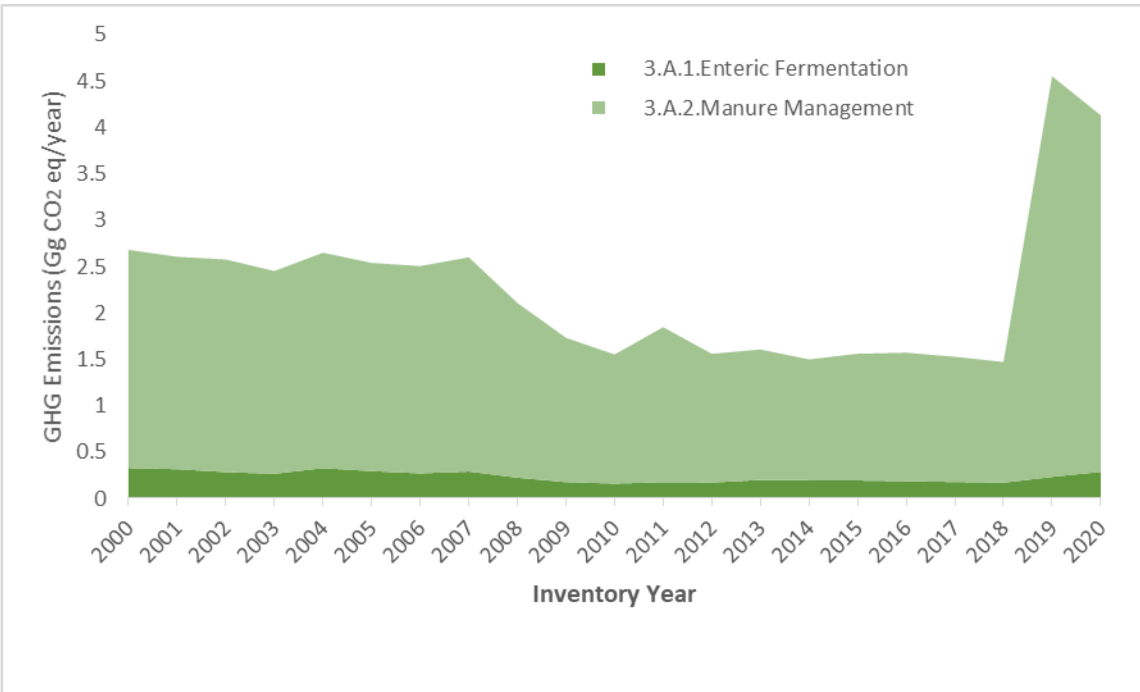


Figure 2-59: Trends in livestock emissions in Seychelles between 2000 and 2020

Table 2. 55: Livestock Population in Seychelles, 2000-2018 (National Statistics)

Species	2000	2005	2010	2015	2018	2019	2020
Other Cattle(number of heads)	147	87	34	65	45	59	102
Goat	NA	NA	NA	NA	NA	132	162
Swine (number of heads)	8,619	9,133	5,363	5,753	5,414	6827	7536

2.18.2 Enteric Fermentation (3A1)

2.18.2.1 Category description

Emissions Sources	Enteric Fermentation Livestock population
Gases Reported	Methane (CH_4)
Methods	Tier 1 for all reported livestock categories Dairy Cattle, Non-Dairy Cattle, Sheep, Goat, Camel, Horse, Donkey, and Mules, using Equation 10.19 and Equation 10.20 of the IPCC 2006 g Guidelines.
Emission Factors	Default EF values from IPCC 2006 Guidelines (Chapter 10, Tables 10.14 - 10.16).
Key Category Analysis	Approach 1 in Vol. 1, Chapter 4 of IPCC 2006 Guidelines.
Completeness	Methane emissions from Non-Dairy Cattle and Swine
Major improvements since the last submission	• The previous inventory of greenhouse gases (GHGs) in the agricultural sector was reported for a limited number of years. GHG estimates are provided annually in the current inventory from 2000-2020. • The previous inventory collected activity data on non-dairy cattle and Swine.

Methane is produced in herbivores as a by-product of enteric fermentation, a digestive process by which plant material consumed by an animal is broken down by bacteria in the gut under anaerobic conditions. A portion of the plant material is fermented in the rumen to simply fatty acids, CO_2, and CH_4. The fatty acids are absorbed into the bloodstream, and the gases are vented through eructation and exhalation by the animal. Unfermented feed and microbial cells pass to the intestines.

In Seychelles, most farmers are predominantly smallholders, practicing agriculture involving livestock rearing. Livestock commonly reared includes cattle, swine, chickens, and, more recently, goats, but further data are needed to estimate emissions from goats.

2.18.2.2 Emissions

Overall, there was a -12.66% decrease in enteric fermentation emission between 2000 and 2020, representing 0.3294Gg/CO2e and 0.2877Gg CO2e emissions for 2000 and 2020, respectively. Enteric fermentation emissions were from other cattle and swine (Table 2-56).

Table 2. 56: Trend and relative contribution of the various livestock categories to the enteric fermentation category between 2000 and 2020

Sub-Category	Emission ($GgCO_2$ eq)		Change (2000-2020)	
	2000	2020	Difference ($GgCO_2$ eq)	%
3.A.1 - Enteric Fermentation	0.3294	0.2877	-0.0417	-12.66

2.18.2.3 Methodological Issues

Seychelles used Tier 1 methods to estimate emissions. Emissions were calculated using Equations 10.19 and 10.20 of the IPPC 2006 Guidelines. Enteric emission factors (EF) for T1 were obtained from Vol. 4 of Chapter 10 of the 2006 IPCC Guidelines, along with Table 10.10 and Table 10.11.

Data for livestock population, Non-Dairy Cattle, and Swine were available from Seychelles' CSA for 2000, 2005, 2010, 2015, and 2018. For the years 2019 and 2020, data were obtained directly from the Department of Agriculture with a comprehensive data on livestock for both years. However, data for the other years were inconsistent or unavailable, and mainly were reported using IPCC interpolation techniques.

Generally, livestock data were more complete after 2003. The typical weight of livestock categories was taken from the IPCC default value as reflected in the 2006 IPCC Guidelines.

2.18.2.4 Category-Specific QA/QC & Verification

Seychelles used the EPA templates for QA/QC procedures, which required filling out quality assurance and control forms for the sector. Moreover, the inventory calculation files were exchanged with other sectors for QA/QC. All sources of data, emission factors, and other factors and constants were referenced using the data templates generated for this project by the AFOLU consultant. Consultations were also done with relevant stakeholders, such as the Livestock Department of the Ministry of Agriculture personnel. Lastly, FAO data were used for verification in some cases.

2.18.2.5 Planned improvements

IPCC Land use category	Data gaps identified (AD and EF)	Planned Improvements /Remarks
Enteric Fermentation	i) A system to collect livestock data from commercial farms and urban areas. ii) Consistent livestock reporting by sub-categories using data collection templates designed for this project. iii) Generalisation of annual livestock census data to regional and national level iv) Country-specific enteric EF	i) Development of a system to collect livestock data from commercial farms and urban areas. ii) Integrating a component in the reporting tool that ensures sub-categories report livestock data. iii) Completion of the mapping and livestock census data at the regional and national level iv) Undertaking of a study to establish country-specific EFs

2.18.3 Manure Management (3A2)

2.18.3.1 Category description

Emissions Sources	Manure management Livestock population
Gases Reported	Methane (CH_4) Nitrous oxide (N_2O)
Methods	Tier 1 for all reported livestock categories Non-Dairy, Swine, and Poultry using

	Equation 10.19 and Equation 10.20 of the IPCC 2006 g Guidelines.
Emission Factors	Default EF values from IPCC 2006 Guidelines (Chapter 10, Tables 10.14 -10.16)
Key Category Analysis	Approach 1 in Vol. 1, Chapter 4 of IPCC 2006 Guidelines.
Completeness	Manure management practices in Seychelles were considered. Methane and nitrous oxide emissions from Non-Dairy, Swine and Poultry, poultry, and broilers were included.
Major improvements since the last submission	• See Section 5.2.2 (Enteric Fermentation) for improvements in livestock data and methodologies relating to livestock-related emissions. • This inventory estimated the emissions from this category using EFs in line with the manure management systems practiced in the country, the percentage contribution of which was established by a combination of country data and expert judgment.

Livestock manure is composed principally of organic material. When the manure decomposes in the absence of oxygen, methanogenic bacteria produce CH4. The amount of CH4 emissions is related to the amount of manure produced and the amount that decomposes anaerobically. These conditions occur most readily when large numbers of animals are managed in a confined area (dairy farms, beef feedlots, poultry farms, etc.) and where manure is disposed of in liquid-based systems. The manure management category also includes N2O emissions related to manure handling before adding it to agricultural soil. The amount of N2O emissions depends on the waste management system and the duration of storage.

2.18.3.2 Emissions

Overall, there was a 66.46 % increase in manure management emissions between 2000 and 2020. This was estimated at 2.351 Gg CO2e and 3.844 Gg CO2e emissions for 2000 and 2020, respectively (Manure management emissions from other cattle, swine, and poultry (Table 2-57).

Table 2. 57: Trend and relative contribution of the various livestock categories to the manure management category between 1990 and 2020

Sub-Category	Emission ($GgCO_2$ eq)		Change (2000-2018)	
	2000	2020	Difference ($GgCO_2$ eq)	%
3.A.2 - Manure Management (1)	2.351	3.844	1.493	63.46

2.18.3.3 Methodological Issues

The IPCC 2006 Guidelines noted that those countries using the Tier 1 method should carefully choose emission factors (EF) closely resembling their animal operations (Tables 10.14 - 10.16). These emission factors represented the manure management practices presented in Table 10A-4 through Table 10A-9 of Vol. 4, Chapter 10 of the IPCC 2006 Guidelines. At the time of this inventory, two manure management systems (MMS) were identified as practices based on expert opinion in Seychelles. Those were solid storage and liquid slurry. MMS differed for the different livestock types, as outlined in Table 2-58.

Table 2. 58: Manure management systems practices in Seychelles

Livestock	Liquid Slurry	Daily Spread	Burned as Fuel	Dry Lot	Poultry Without Litter	Poultry With Litter	Solid Storage	Sum
Non-Dairy	0	0	0	0	0	0	100	100
Swine	100	0	0	0	0	0	0	100
Poultry	0	0	0	0	0	0	100	100

Tier 1 method was used with Equation 10.22 from the IPPC 2006 Guidelines. The emission factors (EF) from Vol 4, Chapter 10 of 2006 IPCC Guidelines, Table 10.14 to Table 10.16 were used. Livestock data were employed, and for details of the reader reference is made to the section on enteric fermentation (Section 5.2.3).

2.18.3.4 Category-Specific QA/QC & Verification

Seychelles used the EPA templates for QA/QC procedures that require filling out quality assurance and control forms, with the inventory calculation files also exchanged with other sectors for QA/QC. All sources of data, emission factors, and other factors and constants used were referenced. Expert judgment on manure management was used, and this was done in consultation with national experts such as officers from the Livestock Department of the Ministry of Agriculture.

2.18.3.5 Planned improvements

IPCC Land use category	Data gaps identified (AD and EF)	Planned Improvements /Remarks
Manure Management	i) Lack of country-specific activity data on manure management ii) Lack of country-specific emission factors	i) Development of a system for collecting data on manure management nationally, both on smallholder farms and on commercial farms ii) Undertaking of a study to establish country-specific EFs iii) Develop a system to collect livestock data from commercial farms and urban areas.

2.19 Emissions and removals from Land category (3B)

2.19.1 Category Overview

This section provides estimates of emissions and removals from the Land category, using the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 2006) (hereafter referred to as IPCC 2006 Guidelines) for all the IPCC six land use categories namely Forestland, Cropland, Grassland, Wetlands, Settlements and Other land. IPCC Inventory Software was used to estimate emissions and removals in the Land category. However, it was noted that for Seychelles, the emissions from Grassland, Wetlands, and Other land were too small. Some of the parameters, such as biomass present on land, were not available and, therefore, were not estimated through the area data provided in the land use matrices.

Overall, the land category remained a net sink across the time series from 2000 until 2020 at -278.93 Gg CO2e and -151.34 Gg CO2e, respectively. This constituted a -45.74% decrease in removals since 2000. However, between 2016 and 2018, there was a net decline in the net removals of the Land category, with a net removal of -160.52 Gg CO2e in 2016 and -155.01 Gg CO2e in 2018. The key drivers for this decrease in the land sector's net sink were increased deforestation rates of indigenous forests to pave the way for human settlement in forested areas and, to a lesser extent, for agricultural land (Figure 2-60).

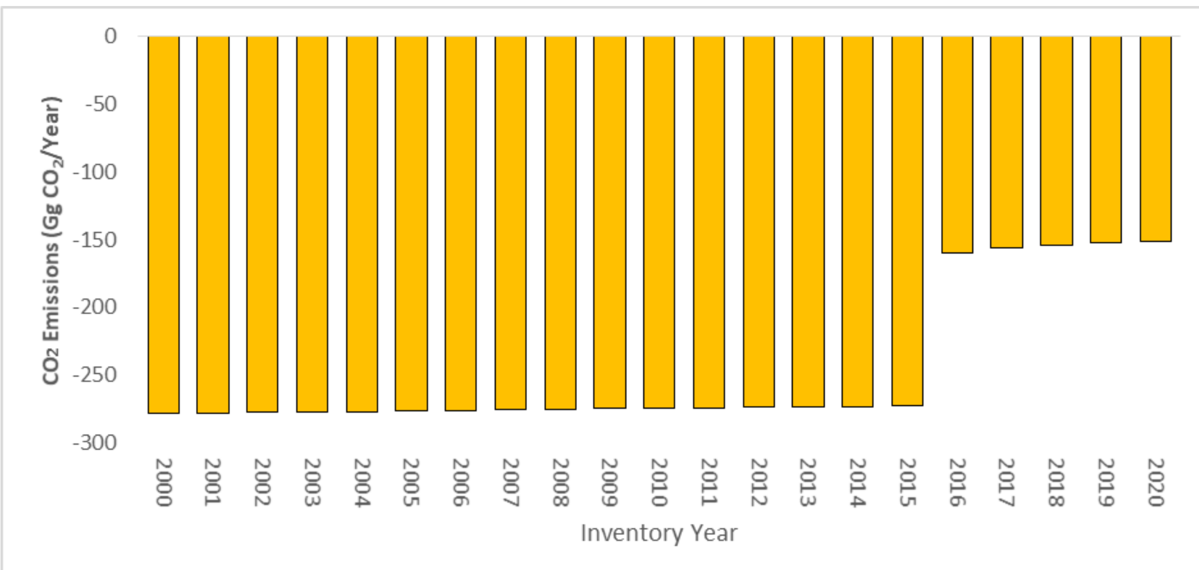


Figure 2-60: Net CO2 emissions and removals (Gg CO2e per year) from the Land category – time series 2000-2020

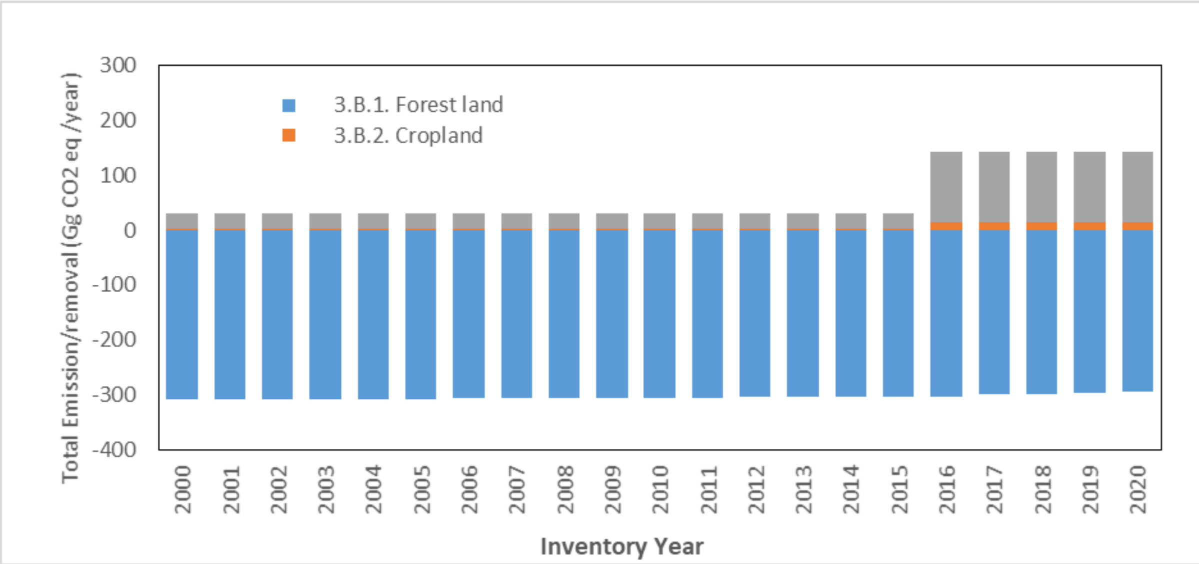


Figure 2-61: Net CO2 emissions and removals (Gg CO2e per year) from the Land category by land-use type from 2000 to 2020

Forest land was responsible for most of the CO2 removals in the sector, and it was a declining sink across the time series from 2000 to 2020 at -308.36 Gg CO2e and -293.50 Gg CO2e, respectively (Figure 2-61). Emissions from Settlements increased and were the largest source of emissions across the time series at 27.23 Gg CO2e in 2000 and 127.49 Gg CO2e in 2020. This was followed by cropland emissions that also showed an increasing trend at 2.19 Gg CO2e in 2000 and 14.67 Gg CO2e in 2020. Lastly, emissions from Grassland, Wetlands, and Other Lands were not estimated as they did not occur.

2.19.2 Land areas and land-use databases were used for the inventory preparation

Land-use maps were the primary source of activity data for land category inventory. Land areas were represented using the IPCC Approach 2 (total land-use area, including changes between categories) for the six identified IPCC land-use categories or sub-categories per ecological zone. IPCC Approach 2 provided an assessment of the net losses or gains in the area of specific land-use categories and what these conversions represented (i.e., changes both from and to a category). Still, it did not provide the spatially explicit location of area data. The result of this approach is presented as non-spatially explicit land-use conversion matrices covering the period 2000 until the current reported year. The main data set for the land categories was derived from the processing of satellite imageries for 2000, 2015, and 2020. Three sets of raster data derived from the supervised classification of Landsat imagery covering the years 2000, 2015, and 2020 were included in preparing this NIR. This means that 2000, 2015, and 2020 land-use maps were produced from wall-to-wall remote sensing and GIS ground-truthing. Activity data used for the land were generated from GIS data maps produced for 4-time steps for 2000, 2015, and 2020. These wall-to-wall maps were generated from 30m resolution of Landsat 5, 7, and Landsat 8 OLI satellite imagery.

All three raster data sets of land use and land cover change data for the years 2000, 2015, and 2020 were produced in Seychelles by an international consultant. Both data sets comprised six land classes generated by supervised classification of Landsat 5, 7, and Landsat 8 OLI imagery.

All the maps provided for the defined areas for the six IPCC land classes. The change detection analysis on the land use data was undertaken for two change pairs for 2000, 2015, and 2020. A pixel-based approach was adopted to enable tracking of land use changes, showing the exact areas of change and transition among classes and areas. The generated change raster maps were used to create land cover change maps between the three epochs of study representing the various land-use changes.

To retain consistency among GHG estimates reported for different years, the total land area was adjusted using a proportional approach to the area covered by all data sets. The adjusted data allowed for the establishment of two land use matrices, namely 2000-2015 and 2015-2020 (Table 56 to Table 57 and Annual transition matrices Table 2-59 to Table 2-60). All matrices were linearly interpolated/ extrapolated to obtain annual land use change data for all individual years within these periods. The yearly land use change data were extrapolated backward to obtain annual land use change data for the period 1980-1990 (due to lack of measured data, it was assumed that for all reported land pre-1990, land uses were not different from the land use in 1990). Land use change data from 1990 to 2000 were obtained from the year 2000, extrapolated backward, and believed that the rates of land use change from 2000 to 2015 were the same (Table 2-61 and 2-62). The 2000 to 2015 annual land use change data were interpolated to obtain annual land use change data for the reported year, while for 2015 to 2020, it was interpolated. In the future, all extrapolated and interpolated data will be replaced/ supplemented by the measured data if resources permit.

Table 2. 59: Land use transition matrix for the period 2000 to 2015

Initial year - 2000 Final Year - 2015								
	2015							
2000								
	Cropland	Forest Land	Grassland	Other Land	Settlements	Wetland	Grand Total
Cropland	**734.804649**	0	0	0	0	0	734.80
Forest Land	57.3812582	**38878.50651**	0	0	673.231182	0	39,609.12
Grassland	0	0	**199.76017**	0	0	0	199.76
Other Land	0	0	0	**1247.228**	0	0	1,247.23
Settlements	0	0	0	0	**3401.873377**	0	3,401.87
Wetlands	0	0	0	0	0	**27.214987**	27.21
Grand Total	792.19	38,878.51	199.76	1,247.23	4,075.10	27.21	45,220.00

Table 2. 60: Land use transition matrix for the period 2015 to 2020

Initial Year - 2015 Final Year - 2020							
	2020						
2015							
	cropland	forest land	grassland	other land	settlements	wetland	Grand Total
Cropland	251.25	0	0	0	0	0	251.25
Forest Land	128.026064	38739.789	0	0	1050.45	0	39,918.27
Grassland	0	0	62.14	0	0	0	62.14
Other Land	0	0	0	762.609	0	0	762.61
Settlements	0	0	0	0	4194.66	0	4,194.66
Wetland	0	0	0	0	0	31.071538	31.07
Grand Total	379.28	38,739.79	62.14	762.61	5,245.11	31.07	45,220.00

Table 2. 61: Annual Land use transition matrix for the period 2000 to 2015

Initail year - 2015 Final Year - 2020								
	2020							
2015		cropland	forest land	grassland	other land	settlements	wetland	Land converted from ...
	Cropland		-	-	-	-	-	-
	Forest Land	25.61		-	-	210.09	-	235.70
	Grassland	-	-		-	-	-	-
	Other Land	-	-	-		-	-	-
	Settlements	-	-	-	-		-	-
	Wetland	-	-	-	-	-		-
	Land converted to ...	25.61	-	-	-	210.09	-	235.70

Table 2. 62: Annual Land use transition matrix for the period 2015 to 2020

Initial year - 2015
Final Year - 2020

2020

2015

	cropland	forest land	grassland	other land	settlements	wetland	Land converted from …
Cropland		-	-	-	-	-	-
Forest Land	25.61		-	-	210.09	-	235.70
Grassland	-	-		-	-	-	-
Other Land	-	-	-		-	-	-
Settlements	-	-	-	-		-	-
Wetland	-	-	-	-	-		-
Land converted to …	25.61	-	-	-	210.09	-	235.70

2.19.3 Land-use definitions and the classification systems used and their correspondence to the Land categories

The IPCC 2006 identifies six broad land-use categories to estimate and report greenhouse gas emissions and removals from land use and land-use conversions. These are (i) Forest Land, (ii) Cropland, (iii) Grassland, (iv) Wetlands, (v) Settlements, and (vi) Other Land. In preparing this inventory, Seychelles used national definitions of land uses consistent with the definitions of the categories referred to in the IPCC 2006 Guidelines as listed below.

Forestland refers to all land with woody vegetation per Global Forest Resource Assessment 2015 definitions (FAO, 2015). This land category was divided into two forest types: plantation and indigenous forests.

Plantation forests refer to the woody vegetation that, at maturity, is predominantly composed of trees established through planting and/or deliberate seeding. These are typically intensively managed and, at maturity, composed of one or two species, have uniform age classes, and have regular tree spacing.

Indigenous forests include all 'Land spanning more than 0.5 ha covered by trees (including bamboo) (with a minimum width of 20m or not more than two-thirds of its length), attaining a height of more than 30m and a canopy cover of more than 20% or trees with the potential to reach these thresholds in-situ in due course.

In summary, this includes systems with a vegetation structure that could potentially reach the proposed national values used to define the indigenous forest land category in Seychelles as follows:

- Minimum mapping unit (MMU) is 0.5 ha
- Minimum tree cover is greater than 20 %
- Potential to reach a minimum height at maturity (in-situ) of 30 m

Cropland refers to parcels of land that are currently cropped or in fallow or with some agroforestry systems where the vegetation structure falls below the thresholds used for the forestland category. This includes land where over 50% of any defined area is used for crop agriculture. This is also divided into perennial and annual cropland. The former is predominantly fruit trees while the latter is a mixture of cereals, pulses, root crops, oils, seeds, and vegetables.

Grassland: This refers to all land dominated by grass cover and includes rangelands and pasture lands that are not considered cropland or forestland. It also includes areas covered by grass and herbaceous plants that fall below the threshold values used in the forestland category, such as other wooded land.

Wetland: This refers to land covered or saturated by water for all or part of the year but does not fall into the forest land, cropland, grassland, or settlements categories. This category is dominated by reservoirs or flooded land as a managed sub-division.

Settlement refers to all developed land, including transport and industrial infrastructure and human settlements.

Other lands: This refers to land covered by bare soil, and rock, as well as all land areas that do not fall into any of the other five categories.

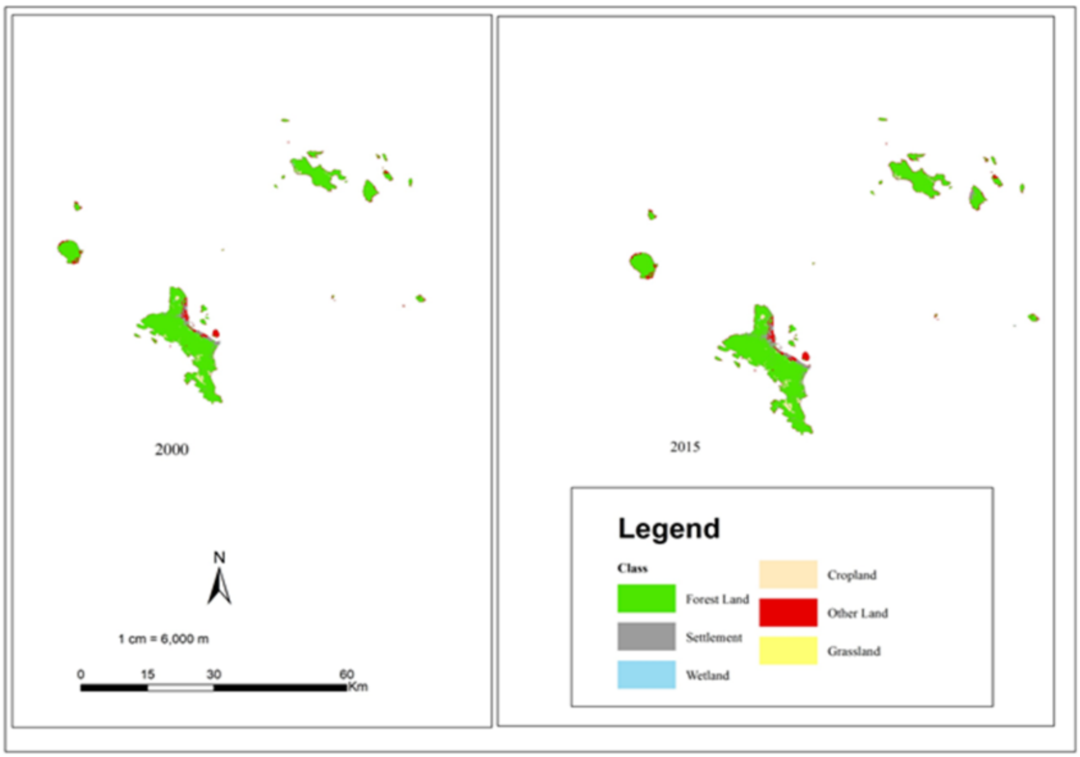
All land within Seychelles was re-classified into the six IPCC land categories, and all were treated in this inventory as managed land. This implies that all land has been accounted for in compiling emissions and removals. The land cover change data by the Seychelles' Geospatial Information Unit was the basis for the land use and land use change analyses. The Lands and Infrastructure Division (LID) was responsible for maintaining the islands' map base.

The original data had eight classes that were condensed to 6, as shown in Table 2-63. Hence, the land change mapping within the land cover classes and between the classes was only done based on the 2006 IPCC land classes (Figure 2-62). See Annex 1 on Land areas by land use category from 1990 to 2020.

Table 2. 63: Land use categories used in the Land category

IPCC 2006		Land Cover Class
1	Forest	Natural Forests or Indigenous Forest
2	Grassland	Grassland
3	Cropland	Cropland
4	Wetland	Wetland Water
5	Settlement	Settlement

6	Other	Bare Soil Lava Flow Rock Outcrop



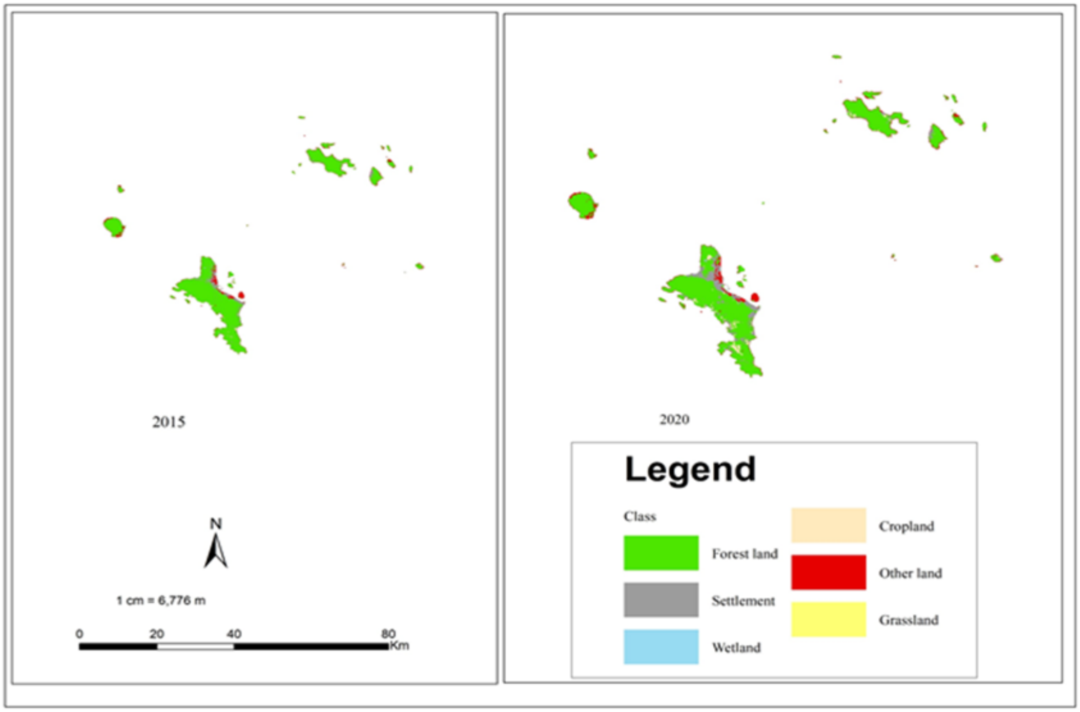


Figure 2-62: Land use maps for Seychelles for the periods 2000, 2015 and 2020

Concerning the 2015 map, an accuracy assessment was undertaken by interpreting collected earth points, some of which were used in refining the classification and the remaining for accuracy assessment. Of the 62 points collected, 45 points were used to improve the classification by correcting the wrongly classified regions while 15 points were used to check the accuracy of the classification. The error matrix is the most common way to present the accuracy of the remotely sensed classification results. The overall accuracy, the users' and the producer's accuracies, along with the Kappa statistic, were derived from the error matrices. The Kappa statistic incorporated the off-diagonal elements of the error matrices and represented agreement obtained after removing the proportion of agreement that could be expected to occur by chance. The overall accuracy of classification imagery dated 2015 was 95.00%, and the Kappa coefficient was 92.00%. The results of the accuracy assessment are provided below in Table 2-64.

Table 2. 64: Confusion matrix for the 2015 image classification of the IPCC classes

			Ground Truth				

		Forest	Settlement	Grassland	Cropland	Other land	Wetland
	Forest	1382	31	0	2	8	0
Mapped	Settlement	6	135	0	0	4	0
	Grassland	0	0	1	0	0	0
	Cropland	0	0	0	2	0	0
	Other land	1	0	0	1	7	0
	Wetland	0	0	0	0	0	2

The confusion matrix above was then used to derive uncertainty information using the approach from Finegold et al., 2016. The analysis indicated a relatively high uncertainty for the 'Wetland' and the Grassland categories (Table 2-65). The rest of the land uses had comparatively low uncertainty.

Table 2. 65: Accuracy assessment and uncertainty of change areas of the six IPCC classes

land use Class	Map area (ha)	Stratified estimated area (ha)*	Confidence interval (ha)	Uncertainty (%)
Forest	37377.21	38739.79	384.34	0.009921095
Cropland	435.15	251.25	112.04	0.445911172
Grassland	45.75	62.14	79.73	1.283064882
Wetland	32.97	31.07	56.56	1.820334261
Settlement	3882.94	4194.66	251.53	0.059965071
Other land	293.42	762.61	269.06	0.352821532

2.19.4 Data and data sources for Land emission factors

Above-ground biomass data for natural forests were taken from the 2006 IPCC default tables. The National Land cover maps provided a detailed wall-to-wall analysis of carbon stocks and flux for woody biomass and herbaceous biomass for forest land. It should be noted that the analysis and assessment included all the ecosystems found within Seychelles (Table 2-66 and 2-67).

Table 2. 66: Overview of the Land categories, data, and data sources in the inventory

Category	Sub-categories	Data Type	Data Source	Data Providers	Remarks
3B Land	3.B.1: Forest Land	Land use maps (2000, 2015, and 2020), Land use change maps (2000, 2015, and 2020), Land), Land use matrix and land use change matrix Accuracy estimates	Seychelles Land Cover, Land Cover Change Analysis for 2000, 2015 and 2020Land Cover Maps)	The land cover change data by the Seychelles' Geospatial Information Unit	The land use change maps were derived from maps for the years 2000, 2015, and 2020 The land representation map matrix and change matrix are in Excel format and obtained from individual land maps. Accuracy assessments were derived from the individual and change matrix.
		Biomass estimates for Above-ground biomass, Below-ground biomass, Deadwood, Litter, and Soil for forestland	IPCC 2006 GHG Inventory Guidelines IPCC 2006 GHG Inventory Guidelines	Seychelles National Team Default IPCC values	Biomass estimates for natural forests (Indigenous Forest) were based on IPCC default values for Tropical rainforest biomes data with similar climate types. Values for deadwood and litter are based on, Soils are IPCC default values.
		Annual Biomass Growth for Natural Forest and Plantation Forests	IPCC 2006 GHG Inventory Guidelines	National Team	Values for increment for biomass estimates for natural forest (Indigenous Forest) are based on Seychelles forest biomes data with similar climate types.
		Ecological zone map	National data	Seychelles' Geospatial	The GIS layer of the ecological zone map was

				Information Unit and Climate Change Commission	used to delineate and calculate the area's ecological zones.
3B Land	3.B.2: Cropland	Data on cropland area was considered as annual area changes across time) according to different management practices. Biomass estimates for Above-ground biomass, Below-ground biomass, Deadwood, Litter, and Soils for the Cropland	Agricultural Survey, Seychelles Land Cover, Land Cover Change Analysis (2000, 2015, and 2020 Land cover maps) IPCC 2006 GHG Inventory Guidelines	Ministry of Agriculture-Seychelles IPCC 2006 GHG Inventory Guidelines	Cropland areas were divided into annual crops according to different management practices. Land use maps and national reports Biomass estimates for above-ground biomass, Below-ground biomass, Deadwood, Litter, and Soils annual and changes across time) according to different management practices.
	3.B.3: Grassland	Data on grassland area and area changes across time Land use matrix	Seychelles Land Cover, Land Cover Change Analysis (2000, 2015 and 2020),	Seychelles' Geospatial Information Institute	Grassland was mapped using remote sensing based on Landsat imagery.
	3.B.4: Wetlands	Land use and land use, change maps, area and change matrix, and Accuracy assessment estimates	Seychelles Land Cover, Land Cover Change Analysis (2000, 2015 and 2020), Land Cover Maps)	Seychelles' Geospatial Information Institute	Data on land use and land use change maps and national reports available
			Biomass present on land	No national data	Work to collect data on Biomass present on land in the improvement plan
	3.B.5: Settlements	Land use and land use, change maps, area and change matrix, and Accuracy assessment estimates.	Seychelles Land Cover, Land Cover Change Analysis (2000, 2015 and 2020), Land Cover Maps)	Seychelles' Geospatial Information Institute	Data-sets (maps and tables, reports) are readily available.

		Biomass estimates for Above-ground biomass, Below-ground biomass, Deadwood, Litter, and Soils for the Settlements	IPCC 2006 GHG Inventory IPCC Guidelines	IPCC 2006 GHG Inventory Guidelines	Biomass, Deadwood, and Litter soils were based on IPCC default values
	3.B.6: Other Land	Land use maps, Land use change map, Land use change matrix	Seychelles Land Cover, Land Cover Change Analysis (2000, 2015 and 2020),	Seychelles Geospatial Information Institute	

Table 2. 67: Emission factors and parameters applied in the estimation of sources and sinks for the Land category

Forest Land

Land Category	Parameter (Symbol)	Units	Value	Source reference for data	Remarks
Forest Land					
Forest Land	Climate Region		Tropical Wet	IPCC 2006 Guidelines	
Forest land	Soil type		High-activity clay mineral	IPCC 2006 Guidelines	
Forest land	Forest type		Natural	IPCC 2006 Guidelines	
Forest land	Age class	years	> 20 years	IPCC 2006 Guidelines	
Forest land	Growing stock level	m^3/ha	> 200	IPCC 2006 Guidelines	
Forest land	C fraction of above-ground biomass	tonne C/tonne dm	0.5	IPCC 2006 Guidelines	
Forest land	The ratio of below-ground biomass to above-ground biomass (R)	t root dm/t shoot dm	0.37	IPCC 2006 Guidelines	
Forest land	Biomass conversion and expansion factor for wood and fuelwood removal ($BCEF_R$)	t/m^3 wood volume	1.050	IPCC 2006 Guidelines	
Forest land	Above-ground biomass	t dm/ha	310.00	IPCC 2006 Guidelines	
Forest land	Above-ground biomass growth	t dm/ha/yr	3.10	IPCC 2006 Guidelines	
Forest land	Reference soil organic carbon stock (SOCRef)	t C/ha	60.00	IPCC 2006 Guidelines	
Land Category	**Parameter (Symbol)**	**Units**	**Value**	**Source reference for data**	**Remarks**
Forest land	Litter carbon stocks of mature forests	t C/ha	2.10	IPCC 2006 Guidelines	
Forest land	Soil stock change factor for land use (F_{LU})	factor	1.00	IPCC 2006 Guidelines	
Forest land	Soil stock change factor for management (F_{MG})	factor	1.00	IPCC 2006 Guidelines	
Forest land	Soil stock change factor for input (F_I)	factor	1.00	IPCC 2006 Guidelines	

Cropland

Land Category	Parameter (Symbol)	Units	Value	Source reference for data	Remarks
Cropland					
Cropland	Climate region		Tropical Wet	IPCC 2006 Guidelines	
Cropland	Soil type		High-activity clay mineral	IPCC 2006 Guidelines	
Cropland	Cropland type		Annual	IPCC 2006 Guidelines	
Cropland	Above-ground biomass	t dm/ha	10.00	IPCC 2006 Guidelines	
Cropland	Reference soil organic carbon stock (SOCRef)	t C/ha	60.00	IPCC 2006 Guidelines	
Cropland	Carbon fraction of dry matter	t C/t dm	0.50	IPCC 2006 Guidelines	
Cropland	Soil stock change factor for land use (F_{LU})	factor	1.00	IPCC 2006 Guidelines	
Cropland	Soil stock change factor for input (F_I)	factor	1.00	IPCC 2006 Guidelines	

Grassland

Land Category	Parameter (Symbol)	Units	Value	Source reference for data	Remarks
Grassland					
Grassland	Climate region		Tropical Wet	IPCC 2006 Guidelines	
Grassland	Soil type		High-activity clay mineral	IPCC 2006 Guidelines	
Grassland	Reference soil organic carbon stock (SOCRef)	t C/ha	60.00	IPCC 2006 Guidelines	
Grassland	Carbon fraction of dry matter	t C/t dm	0.5	IPCC 2006 Guidelines	
Grassland	Soil stock change factor for land use (F_{LU})	factor	1.00	IPCC 2006 Guidelines	
Grassland	Soil stock change factor for management (F_{MG})	factor	1.00	IPCC 2006 Guidelines	
Grassland	Soil stock change factor for input (F_I)	factor	1.00	IPCC 2006 Guidelines	

Grassland	Herbaceous biomass stocks present	t dm/ha	16.10	IPCC 2006 Guidelines	

Land Category	Parameter (Symbol)	Units	Value	Source reference for data	Remarks
Grassland	Woody biomass stocks	t dm/ha	0.0	No national data	No estimation was done for grassland as this was a very small category
Grassland	Herbaceous biomass stocks after conversion from other land use (B_{after})	t dm/ha	16.10	IPCC 2006 Guidelines	
Grassland	Woody biomass stocks after conversion from other land use (B_{after})	t dm/ha	0.00	No national data	No estimation was done for grassland as this was a very small category
Grassland	Carbon fraction of dry matter for herbaceous biomass	t C/t dm	0.47	IPCC 2006 Guidelines	
Grassland	Carbon fraction of dry matter for woody biomass	t C/t dm	0.50	IPCC 2006 Guidelines	

Wetlands

Land Category	Parameter (Symbol)	Units	Value	Source reference for data	Remarks
Wetlands					
Wetlands	Climate region		Tropical Wet	IPCC 2006 Guidelines	
Wetlands	Soil type		High-activity clay mineral	IPCC 2006 Guidelines	
Wetlands	Biomass stocks after conversion from other land use (B_{after})	t dm/ha	0.00	No National data	No estimation was done for Wetlands as this was a very small category
Wetlands	Biomass present on land	t dm/ha	0.00	No National data	No estimation was done for Wetlands as this was a very small category
Wetlands	Carbon fraction of dry matter	t C/t dm	0.47	IPCC 2006 Guidelines	

Wetlands	CO_2 emission factor for peat soils	t C/ha/yr	0.00	NE	NE notation key Seychelles has not estimated peat soils in this inventory
Wetlands	N_2O emission factor for drained nutrient-rich organic soils	kg N_2O-N/ha/yr		NE	NE notation key Seychelles has not estimated peat soils in this inventory

Land Category	Parameter (Symbol)	Units	Value	Source reference for data	Remarks
Wetlands	Carbon fraction of air-dry peat by weight	t C/t peat		NE	
Wetlands	Carbon fraction of air-dry peat by volume	t C/m^3 peat		NE	

Settlements

Land Category	Parameter (Symbol)	Units	Value	Source reference for data	Remarks
Settlements					
Settlements	Climate region		Tropical Wet	IPCC 2006 Guidelines	
Settlements	Soil type		High-activity clay mineral	IPCC 2006 Guidelines	
Settlements	Biomass present on land	t dm/ha	0.00	No national data	Improvement plan to collect data.
Settlements	Reference soil organic carbon stock (SOCRef)	t C/ha	60.00	IPCC 2006 Guidelines	
Settlements	Carbon fraction of dry matter	t C/t dm	0.50	IPCC 2006 Guidelines	
Settlements	Soil stock change factor for land use (F_{LU})	factor	1.00	IPCC 2006 Guidelines	
Settlements	Soil stock change facto for management (F_{MG})	factor	1.00	IPCC 2006 Guidelines	
Settlements	Soil stock change factor for input (F_I)	factor	1.00	IPCC 2006 Guidelines	

Other Lands

Land Category	Parameter (Symbol)	Units	Value	Source reference for data	Remarks
Other lands					
Other lands	Climate region		Tropical Wet	IPCC 2006 Guidelines	
Other lands	Soil type		High-activity clay mineral	IPCC 2006 Guidelines	
Other lands	Biomass present on land	t dm/ha	0.00	IPCC 2006 Guidelines	
Other lands	Reference soil organic carbon stock (SOCRef)	t C/ha	60.00	IPCC 2006 Guidelines	
Other lands	Carbon fraction of dry matter	t C/t dm	0.50	IPCC 2006 Guidelines	
Other lands	Soil stock change factor for land use (F_{LU})	factor	1.00	IPCC 2006 Guidelines	
Other lands	Soil stock change facto for management (F_{MG})	factor	1.00	IPCC 2006 Guidelines	
Other lands	Soil stock change factor for input (F_I)	factor	1.00	IPCC 2006 Guidelines	

2.20 Forest land (3B1)

2.20.1 Category description

Emissions Sources	Forestland: Carbon stock Change
Gases Reported	CO_2
Methods	Tier 1 Loss and Gain Method Equation 2.7 for estimating carbon stock changes using IPCC Inventory Software
Emission Factors	IPCC default values were used for AGB and annual increment (growth rates).
Key Category Analysis	Forest land - CO_2 (L1, L2)
Completeness	All carbon pools are estimated
Major improvements since the last submission	- Use of Approach 2 for land representation of land areas and land area changes instead of Approach 1 - Spatially explicit analysis based on GIS-based land cover/land use raster maps. - Calculation of the annual change using the new map overlays.

In this inventory, Forest land includes both Indigenous forests and natural plantation forests. In the future, Seychelles intends to disaggregate forest land into Indigenous Forest (natural) and natural Plantation forests as new data become available.

Seychelles is a land of natural beauty. It stretches over 45,220 hectares (ha) of land and has tropical wet climate zones and soil conditions. It is estimated that the forest area of Seychelles is 40,670 ha, i.e., 88.4% of the total land area. About 88.2% of the forest areas are natural, albeit with a strong influence of exotic species like the invasive Albizia (Paraserianthes falcataria). Natural plantations have historically been established with nearly only exotic species, including casuarina (Casuarina equisetifolia), mahogany (Swietenia macrophylla), and Santol (Sandoricum koetjape indicum), covering approximately 5,000 ha. The forest ownership in 2010 was 31,000 ha on public land and 10,000 ha on private land. Approximately half of the forest areas were within protected areas. The growing stock was estimated at 3 million m^3 or 74 m^3/ha. The estimated annual wood removal was as low as 10,000 m^3 (Seychelles National Forest Policy Document, December 2021). Historically, the main island of Mahé had exceptional hardwood forests (e.g., Mimusops sechellarum, Vateriopsis seychellarum, Intsia bijuga) on the coastal plains and lower mountain slopes exhibiting very tall (30m), straight trees of colossal girth. The intermediate and higher slopes were likewise heavily forested with valuable timber (e.g., Northea hornei, Dillenia ferruginea, M. sechellarum, V. seychellarum), though of lesser proportions. Valuable timber forests were found on the main islands of Mahé, Silhouette, Praslin, and La Digue and, to a lesser extent, on islands such as Saint Anne, Cerf, Felicite, and Curieuse. Also of note were the Palmaceae (six species in six monotypic genera) with a wide range of habitat preferences and often forming palm-dominated communities in the dryer and more exposed regions – most notably on the islands of Praslin and Curieuse where the famous Coco-de-mer (Lodoicea maldivica) dominated such communities (Nevill, 2011).

More recently, Seychelles developed the National Forest Policy that, among other things, articulated how Seychelles' forest resources should be managed, established the basis for planning and action for forest resource management and forest-related biodiversity conservation, and provided the impetus and the direction for enacting legislation and regulation to strengthen sustainable national forest management. According to FAO statistics, the direct sector GDP contribution of the Forest Sector is presently approximately nil. The country had undergone structural adjustments and sectoral reforms to open the economy through trade liberalization. Investments in forestry programs require a long time to generate returns. It was intended that the zation of the National Forest Policy would support the resuscitation of the forest sector concerning more coordinated management of forest products (Michel Vielle, 2021).

In Seychelles, land tenure is a mixture of state and private land ownership. Thus, all land contains forests and thus recognizes two types of management/ownership i.e., State Forest and Private Forest. For forest governance, Seychelles had fielded several national strategies and enacted legislations that impact forests, namely the Breadfruit and Other Trees (Protection) Act, 1917). This Act prohibited the destruction or any form of destruction of any tree specified in the Schedule without written permission from the Chief Agricultural Officer and defines destroying as including felling, cutting, or barking of a tree (Government of Seychelles, 1917). The Town and Country Planning Act of 1972, had been the legal instrument regulating national land use planning and construction and was recently revised. Once assented to by the President, it provided a revised framework for regulating land use planning to bring about sustainable development in Seychelles (Government of Seychelles, 2012b). The Wetland Policy 2019 - 2022 acknowledged that wetlands were essential for sustainable development and that wise use was paramount and sought to promote sustainable management of Seychelles wetlands to improve ecosystem services, increase resilience to climate change, and deliver biodiversity (MoEE, 2013). This policy sought to provide a national policy framework for elaborating legislation and related guidelines for establishing, coordinating, guiding, and managing PAs in Seychelles (Michel Vielle, 2021).

2.20.2 Emissions and removals

Forest Land includes carbon stock gains, losses, and GHG emissions from forest management. Overall, it was the only net sink in the Land Inventory in the Seychelles at -278.93 Gg CO2e in the year 2000 and at -151.34 Gg CO2e in 2020. This represented a 2.41% decrease over that period (Figure 2-63). It was evident that the forest sink decreased slightly across the time series and that the decline was more pronounced between 2017 and 2018. The decrease was related to the conversion of forestland to settlements, followed by forestland to cropland. The remaining forest and land converted to forest land were responsible for most of the CO2 removals in the sector across the time series and were an increasing sink across the time series. Seychelles reported carbon stock changes in all forests using IPCC Inventory Software. Carbon stock changes resulting from forestland remaining forest land areas were computed. The reported forest area and carbon stock changes accounted for losses due to forest land converted to other land use categories (deforestation), and the associated carbon stock changes, emissions, and removals were then estimated and reported under the category concerned. Seychelles did not estimate the carbon stocks in the Harvested Wood Products pool due to a lack of data.

Forest land comprises emissions and removals from forest land, remaining forest land, and land converted to forest land. The remaining forest land included natural plantation forests and indigenous forests.

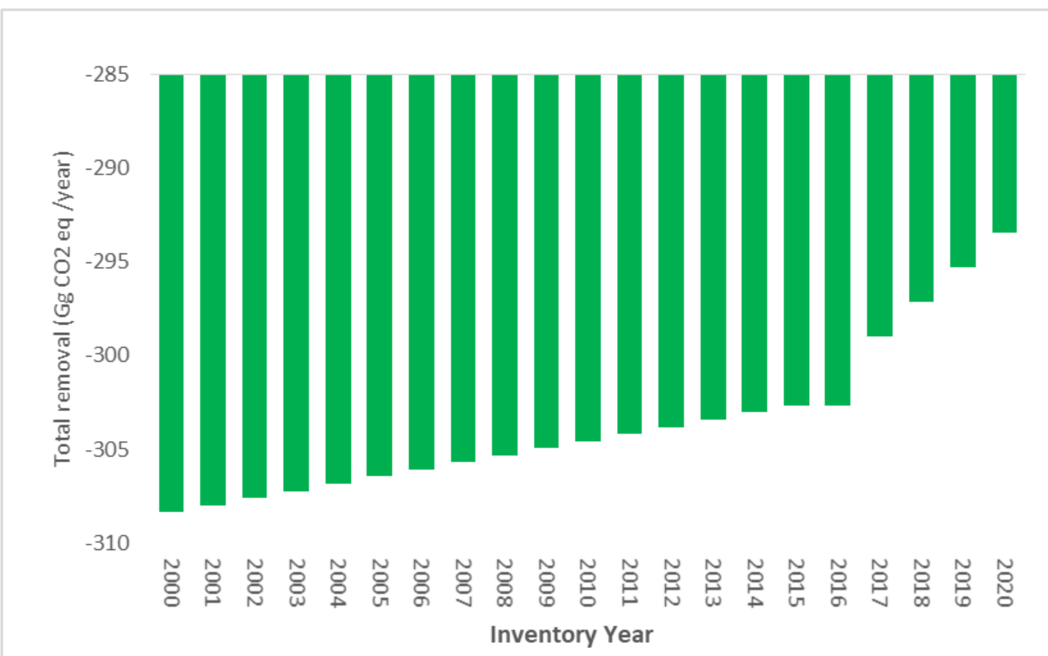


Figure 2-63: Forest land removals for Seychelles between 2000 and 2020

2.20.3 Methodological issues

In this inventory, the IPCC Gain and Loss Equation 2.4, page 2.9, Vol 4, IPCC 2006 Guidelines was used to produce estimates of forestland (indigenous and plantation forests), and calculations were performed using the IPCC Inventory software (Version 2.69). Gain-Loss Method (Tier 1) Equation 2.7 was used to estimate the annual change in carbon stocks in living-above and below-ground biomass. Considering the region-specific data on yearly mean increment, Seychelles used IPCC default values for AGB and growth rates, commercial cutting, and fuelwood removal (2000-2020, and the rest was interpolated for the missing years) for forest land. IPCC default values for the biomass expansion factors (BCEFI, BCEFR), basic wood densities (D), default root-to-shoot ratios (R), and carbon fractions (CF) were used.

The annual biomass loss is the sum of losses from commercial round wood felling, fuelwood gathering, and other losses in forest land. These were calculated by Equation 2.11 of Volume 4 of the 2006 IPCC Guidelines. For example, commercial round wood felling, fuelwood gathering, and other losses were computed in different worksheets according to Equation 2.12, Equation 2.13, and Equation 2.14, respectively. The calculations of biomass losses are consistent with the IPCC 2006 Guidance for AFOLU (Vol 4). Biomass gains and biomass losses were estimated separately. Deadwood and litter values were based on the IPCC default values. The IPCC default values were used to estimate the soil carbon pool.

2.20.4 Category-specific QA/QC and verification

Activity data (GIS) were cross-checked with officially reported data from the Seychelles' Geospatial Information Institute. Furthermore, consultations with various forestry and land use stakeholders were undertaken to ensure consistency and agreement on the data and the EF. The data were stored and shared between experts to guarantee that all changes were easily traceable. The IPCC Inventory Software Version 2.691 was used to compile all the Land inventory numbers and associated data. This database was used to produce consistent outputs for reporting and archiving purposes. A Technical Working Group of experts focusing on the Land category was established and provided technical review and input into the sector inventory. The IPCC QA/QC procedure was adopted using the EPA template.

2.20.5 Planned improvements

IPCC Land use category	Data gaps identified (AD and EF)	Planned Improvements /Remarks
Forest Land		
Indigenous forests	i) Data for deadwood	

	ii) Data on fuelwood collection	Collection of country-specific data on deadwood by forest type for Savanna woodlands
	iii) Disaggregated data for land areas to other land uses	Collection of country-specific data on fuelwood
	iv) Information on BCEF by forest and species type	Collection of information on BCEF by forest and species type
	v) Disaggregated area and area change data by forest type and species type across the inventory time series.	Collection of disaggregated area and area change data by forest type and species type across the inventory time series.
	vi) Growing stocks and annual volume increments by forest type for indigenous species	Collection of data on growing stocks and annual volume increments by forest type for indigenous species
Natural Plantation Forests	i) Data on land areas disaggregated by species type, e.g., casuarina (Casuarina equisetifolia), mahogany (Swietenia macrophylla) and Santol (Sandoricum koetjape indicum)	Collection of country-specific data on deadwood by forest type and species type e.g.casuarina (Casuarina equisetifolia), mahogany (Swietenia macrophylla) and Santol (Sandoricum koetjape indicum)
	ii) Data for deadwood by species type	
	iii) Data on wood removals disaggregated by species type e.g., casuarina (Casuarina equisetifolia), mahogany (Swietenia macrophylla) and Santol (Sandoricum koetjape indicum)	Collection of country-specific data on wood removals and fuelwood by forest type and species type e.g., casuarina (Casuarina equisetifolia), mahogany (Swietenia macrophylla) and Santol (Sandoricum koetjape indicum)
	iv) Data on fuelwood disaggregated by species type (Pine, Wattle, and Eucalyptus)	Collection of data areas and land area change at a disaggregated level by forest type and species
	v) Disaggregated data for land areas to other land uses by forest type and species	Collection of disaggregated data for land areas to other land uses by forest type and species for plantations
	vi) Information on BCEF by forest and species type	
	vii) Growing stocks and annual volume increments by forest type for plantation	Collection of Information on BCEF by forest and species type Collection of data on Growing stocks and annual volume

		increments by forest type for plantation

2.21 Cropland (3B2)

2.21.1 Category description

Emissions Sources	Cropland: Carbon stock Change
Gases Reported	CO_2
Methods	Tier 1 Loss and Gain Method Equation 2.7 for estimating carbon stock changes using IPCC Inventory Software
Emission Factors	IPCC default values were used for annual crops for biomass, stock change factors
Key Category Analysis	Land converted to cropland (L1)
Completeness	All carbon pools are estimated.
Major improvements since the last submission	- Use of Approach 2 for land representation of land areas and land area changes instead of Approach 1 - Spatially explicit analysis based on GIS-based land cover/land use raster maps. - Calculation of the annual change using the map overlays.

2.21.2 Emissions and removals

Croplands refer mainly to crop fields on which annual crops are cultivated and temporary fallow land. Seychelles cropland production systems consist of Oilseeds, Vegetables, Root Crops, and Fruit Crops, i.e., banana, Chinese cabbage, cabbage, tomato, eggplant, cucumber, pumpkin, okra, chili sweet corn, radish, coconuts, cinnamon, vanilla, sweet potatoes, cassava. Cropland comprises emissions and removals from cropland remaining cropland, land converted to cropland, and mainly forest land converted to cropland. GHG Emissions associated with farmland management practices, such as fertilizer application, handling of crop residues, burning, etc., were reported under 3C. However, emissions from biomass burning were not reported due to a lack of data. Forest land-cropland conversion was the most significant emission contributor to the conversion categories. This means that deforestation through cropland expansion had been identified as one of the key categories in the entire emission inventory. It occurred across the country with varied degrees of intensity. The drivers of the forest-cropland conversion were localized, but factors such as type of crop, agronomic, and management practices influenced the emission levels.

In 2000, emissions from cropland were at 2.193 Gg CO2e and 14.67 Gg CO2e in 2020 (Figure 2-64). This represented an increase of 568.67% across the time series. Cropland was the second largest source of net CO2 emission in the land category.

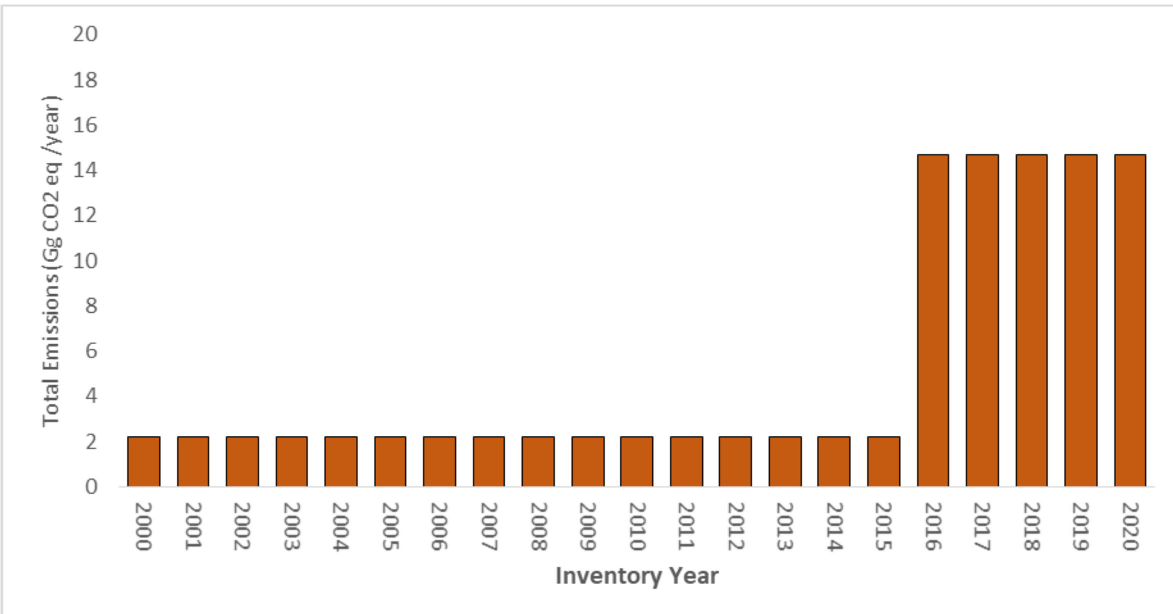


Figure 2-64: Trends in Cropland emissions in Seychelles between 2000 and 2020

2.21.3 Methodological issues

In this inventory, the IPCC Gain and Loss Equation 2.4, page 2.9, Vol 4, IPCC 2006 Guidelines was used to produce emission estimates for croplands (irrigated and subsistence), and calculations were performed using the IPCC Inventory software (Version 2.69). Gain-Loss Method (Tier 1) was used to estimate emissions from cropland remaining annual cropland and land converted to cropland.

Above- and below-ground biomass

For annual crops, an increase in biomass stocks in a single year was assumed to be equal to biomass losses from harvest and mortality in that same year (IPCC 2006).

a. Dead organic matter (DOM)

According to the Tier 1 method, there is no need to estimate the carbon stock changes for DOM. A Tier 1 method considers the estimation of CSC in the dead organic matter only for major conversion categories (e.g., forest land to cropland). It is assumed that all dead organic matter is removed in the year of conversion, so there is no accumulation in land converted to cropland afterward.

Reference to 2006 IPCC equation: Vol. 4., Ch. 2: 2.23.

b. Mineral and organic soils

There is no specific data on management systems in the country to apply reference carbon stocks and stock change factors. Emissions from organic soil were not estimated.

Reference to 2006 IPCC equations: Vol. 4., Ch. 2: 2.24 / 2.25 /

c. Above- and below-ground biomass

Changes in biomass carbon stocks have been estimated according to Tier 1 with activity data for annual crops. Conversions from forest land to cropland occurred in the country. No other land use to cropland occurred. The principle of estimating the CSC in biomass in land converted to cropland assumes that biomass loss is accounted only for the year of conversion. Thus, ΔC conversion must be multiplied by the annual area (i.e., the area in the year of the conversion).

Reference to 2006 IPCC equations: Vol. 4., Ch. 2: 2.15 / 2.16

d. Category-specific QA/QC and verification

This was compared to data from the Ministry of Agriculture, and it became evident that the GIS data was of a higher visualization with a better representation of the landscape, including trees, shrubs, and fallow areas. This deviation could be attributed to the differences in the approaches to estimating area. The agriculture surveys utilized interviews and visual estimates of the planted area. Hence, the official data tended to exclude fallow land, trees, and other shrubs, which were part of cropland as per the IPCC definition of cropland. This assessment will need to be improved in the next submission.

2.21.4 Planned improvements

IPCC Land use category	Data gaps identified (AD and EF)	Planned Improvements /Remarks
Cropland		
Cropland Annual crops:	i) Data on land area conversions to other land uses by crop type ii) Data AGB by crop type iii) Country-specific stock changes factors by crop type (management/LU, inputs, and tillage) iv) Disaggregation of crop data between annual and perennial crop types	i) Collection of country-specific information on area conversions to other land uses by crop type ii) Collection of country-specific data AGB by crop type iii) Collection of country-specific stock change factors by crop type iv) Collection of information on area/area change and country-specific stock change factors by crop type for perennial crops v) Collection of ABG/ growth/Increment for perennial crops vi) Collection of data on litter and deadwood for perennial crops vii) Collection of data on biomass accumulation rates and biomass loss for perennial crops

2.22 Settlements (3B5)

2.22.1. Category description

Emissions Sources	Settlements: Carbon stock Change
Gases Reported	CO_2
Methods	Tier 1 Loss and Gain Method for carbon stock changes using IPCC Inventory Software
Emission Factors	IPCC default values all parameters except biomass present on the land, with no country-specific values for biomass stocks present on the land.
Key Category Analysis	Settlements CO_2 (L1, L2)
Completeness	All carbon pools are estimated.
Major improvements since the last submission	Spatially explicit analysis based on GIS-based land cover/land use raster maps; Calculation of the annual change using the new map overlays.

2.22.2 Emissions and removals

Settlements comprised of emissions and removals from remaining settlements and forest land converted to settlements. Settlements included rural settlements, infrastructure, and urban areas that were detectable from satellite imagery. However, it should be noted that the settlements may have been underestimated since rural homesteads are typically surrounded by and interspersed within cropland and other vegetation, thereby increasing the probability of their spectral signature being missed by satellite imagery.

The conversion of forestland (especially of indigenous forest) to settlements significantly contributed to the settlement's category. The expanding human population and urbanization drove this. In 2000, emissions from settlements were at 27.23 Gg CO2e, and remained stable across the time series, with a sharp increase to a peak of 127.48 Gg CO2e between 2016 and 2020 (Figure 2-65).

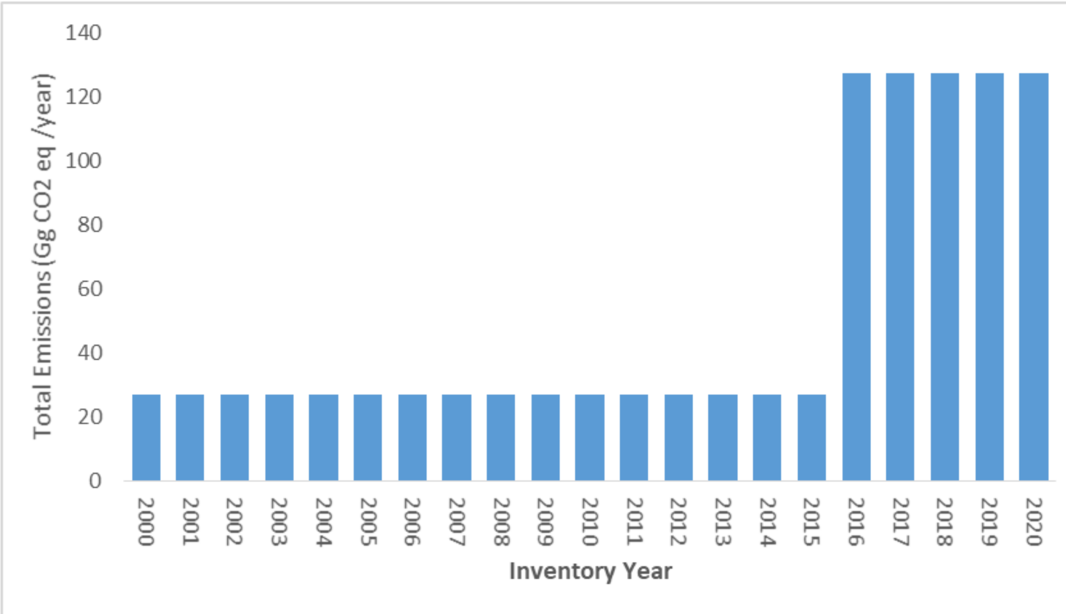


Figure 2-65: Trends in Settlement emissions in Seychelles between 2000 and 2020

2.22.3 Methodological issues

In this inventory, the IPCC Gain and Loss Equation 2.7 of the IPCC 2006 Guidelines was used to produce estimates for changes in carbon stocks for settlements with computations performed using the IPCC Inventory software (Version 2.691).

Activity data were derived through wall-to-wall supervised classification of Landsat imagery covering 1990, 2000, 2010, and 2015. This meant that GIS-based settlement maps for 1990, 2000, 2010, and 2015 were produced from wall-to-wall remote sensing and ground-trothing. Estimation methods were based on IPCC 2006, Vol4, Ch8.

All carbon pools in Settlements remaining Settlements (SL-SL) were assumed to be not changing and thus reported as NO. Tier 1 assumed that there was no change in carbon stocks in live biomass in settlements, remaining settlements; in other words, that the growth and loss terms were balanced. Thus, the carbon stock change in settlements remaining settlements had not been estimated.

Land converted to settlements was estimated and showed an increasing trend in emissions. The primary driver of the emissions was conversions from forest land that resulted in the loss of carbon.

2.22.4 Land converted to Settlements

Above- and below-ground biomass

Country-specific values for biomass stocks present on land.

- Changes in biomass carbon stocks had been estimated according to Tier 1. Conversions from all other land uses to settlements occurred nationally. The principle of calculating the CSC in biomass in land converted to settlements assumed that biomass loss was accounted only for the year of conversion. Thus, ΔC conversion must be multiplied by the annual area (i.e., the area in the year of the conversion).

- Reference to 2006 IPCC equations: Vol. 4., Ch. 2: 2.15 / 2.16

Dead organic matter

- A Tier 1 method considered the estimation of CSC in the dead organic matter only for major conversion categories (e.g., forest land to settlements). It was assumed that all dead organic matter was removed in the year of conversion, so there was no accumulation in land converted to settlements afterward.

Reference to 2006 IPCC equation: Vol. 4., Ch. 2: 2.23

Change in soil organic C stocks could be estimated for mineral soils with land-use conversion to Settlements using Equation 2.25 in Chapter 2 using a Tier 1 method.

2.22.5 Category-specific QA/QC and verification

Activity data (GIS) was cross-checked with land tenure data from Seychelles' National Bureau of Statistics. Internal consultations with various national experts were undertaken to ensure consistency and agreement concerning the activity data and EF. The data were stored and shared among experts to guarantee that all changes were easily traceable. The IPCC Inventory Software Version 2.691 was used to compile all the Land inventory numbers and associated data. This database was used to produce consistent outputs for reporting and archiving purposes. A Technical Working Group of experts focusing on the Land category was established and provided technical review and input into the sector's inventory.

2.22.6 Planned improvements

IPCC Land use category	Data gaps identified (AD and EF)	Planned Improvements /Remarks
Settlements	i) High-resolution data on land area conversions to settlements. ii) Data AGB by wetland type i.e., urban vs. rural settlements iii) Country-specific stock change factors for settlements iv) Areas for settlement and stock change factors v) AGB for settlements vi) Data on biomass accumulation rates and biomass loss for settlements	i) Collection of country-specific information on area conversions to other land uses for settlements. ii) Collection of country-specific data AGB by settlement type i.e., rural vs. urban iii) Collection of country-specific stock change factors for settlements iv) Collection of information on area/area change and country-specific stock change factors for settlements v) Collection of ABG/ growth/increment for settlements vi) Collect data on biomass present on land in accordance with IPCC 2006 Guidelines

2.23 Emissions and removals from Aggregated and non-CO2 emissions on land (3C)

2.23.1 Category overview

Overall, total national emissions from aggregated and non-CO2 emissions on land showed a decreasing trend from 12.174 Gg CO2e in 2000 to 9.112 Gg CO2e in 2020. This represented a 25.15% decrease across the time series. Emissions from direct N20 dominated the emissions in this sub-sector in soils, which were at 10.354 Gg CO2e in 2000 and 6.001 Gg CO2e in 2020 (Figure 2-66). The key driver for this decrease was the relative use of nitrogen fertilizers in agricultural soil. The use of urea application in soils was the second largest emission source, followed by Indirect N2O and manure management. Seychelles did not estimate emissions from biomass burning due to a lack of data but plan to assess in the future once data becomes available. Regarding timing, the data were very scarce, and the estimation was based on a few years and had very high levels of uncertainty.

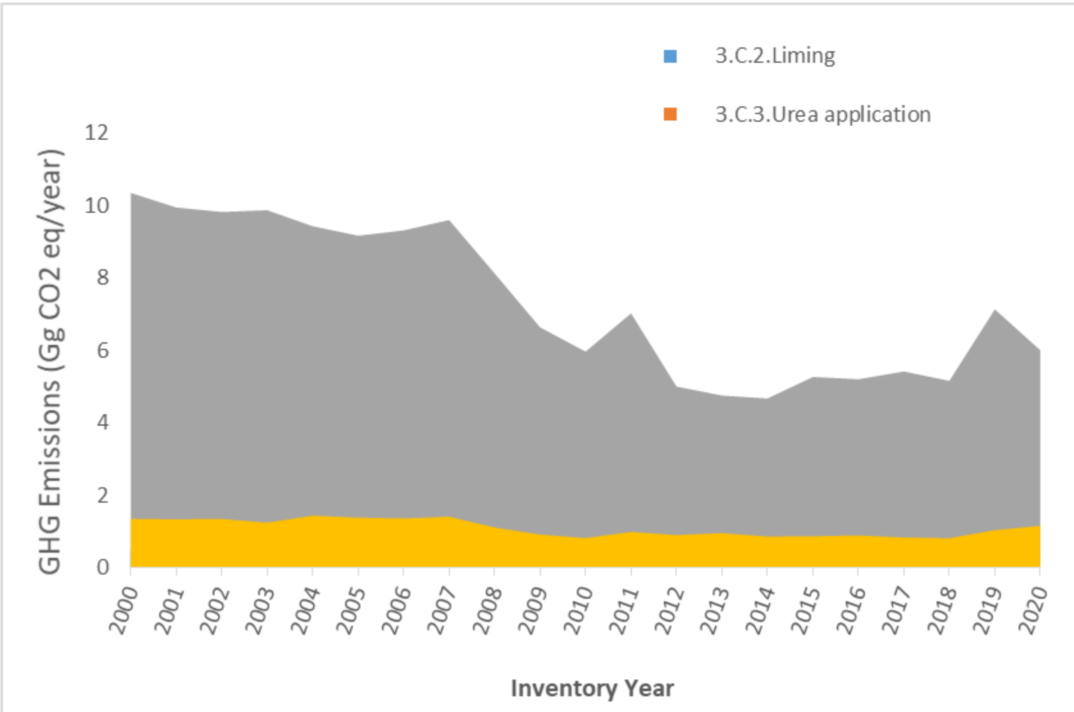


Figure 2-66: Trends in aggregated and non-CO2 emissions on land in Seychelles between 2000 and 2020

2.24 Urea application (3C3)

2.24.1 Category description

Emissions Sources	Urea application
Gases Reported	Carbon dioxide (CO_2)
Methods	Tier 1 method was used with Equation 11.13 of the IPCC 2006 Guidelines.
Emission Factors	Default EF from the IPCC 2006 Guidelines (Chapter 11), value of 0.2.

Key Category Analysis	Key category (L1 and L2) Approach 1 in Vol. 1, Chapter 4 of IPCC 2006 Guidelines.
Completeness	Emissions were estimated from urea imports that was assumed to have been soil applied.
Major improvements since the last submission	This category of Urea application (3C3) was not reported in the previous inventory. This inventory reported emissions from urea for the first time.

During the fertilizer manufacturing process, CO2 gets fixed in the fertilizer granules. Therefore, adding urea to soils during fertilization leads to a release/loss of this CO2 into the atmosphere. Emissions from Urea were not an essential category in Seychelles and were generally in decline.

2.24.2 Emissions

Between 2000 and 2020, there was a notable fluctuation in emissions from urea application across the time series at 0.00246 Gg CO2e in 2000 and 0.00823 Gg CO2e in 2020 (Table 2-68). This represented an increase of 70.11% since 2000. There was an average of 0.01 Gg CO2eq per year, with a peak of 0.059 Gg CO2eq in 2009 (Figure 2-67). This peak was after the financial crisis 2008 2008, following which Seychelles received a donation of urea fertilizer from FAO to boost local agricultural production.

Table 2. 68: Trend and relative contribution of the urea application category between 2000 and 2020

Sub-category	Emissions (Gg CO_2e)		Change (2000 – 2020)	
	2000	2020	Difference (Gg CO_2e)	%
Urea application	0.00246	0.00823	0.00577	-70.11%

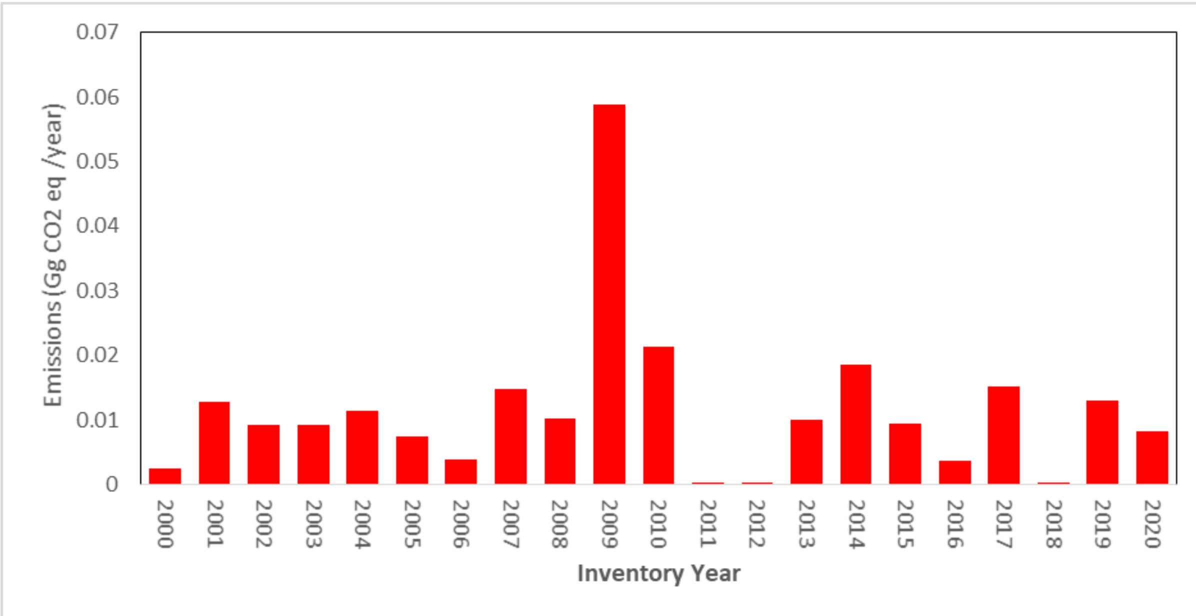


Figure 2-67: Trends in CO2 emissions from Urea application (3.C.3.) for Seychelles between 2000 and 2020

2.24.3 Methodological Issues

Tier 1 method was used, applying Equation 11.13 from the IPCC 2006 Guidelines, using an emission factor of 0.2. The emission factors (EF) were obtained from Vol 4, Chapter 2 of the 2006 IPCC Guidelines. Activity data for the amount of urea applied were taken from the National Bureau of Statistics (NBS, 2021). A default emission factor (EF) of 0.02 for carbon emissions from urea applications was used from the 2006 IPCC Guideline (Eggleston et al., 2006). In cases where data were unavailable from the IPCC, gap-filling techniques for interpolation and extrapolation were used.

2.24.4 Category-Specific QA/QC & Verification

Following EPA's QA/QC procedures, quality assurance and control forms were completed for the sector. Moreover, the inventory calculation files were exchanged with other sectors for QA/QC. National experts and consultants provided technical review and input into the sector’s inventory and even verified the applied calculation procedures.

2.24.5 Planned improvements

IPCC Land use category	Data gaps identified (AD and EF)	Planned Improvements /Remarks
Urea application	i) Lack of country-specific activity data ii) Urea import data with gaps iii) Urea import data with inconsistencies	i) Develop country-specific data collection templates during the project to collect data for urea application. ii) Improvement in the recording and records keeping of import records for urea

2.25 Direct N2O emissions from managed soils (3C4)

2.25.1 Category description

Emissions Sources	Direct N_2O emissions from managed soils Fertilizer inputs
Gases Reported	Nitrous oxide (N_2O)
Methods	Tier 1 method was used using Equation 11.1 of the IPCC 2006 Guidelines.
Emission Factors	Default from IPCC 2006 Guidelines (Table 11.1)
Key Category Analysis	Key category L1, L2 Approach 1 in Vol. 1, Chapter 4 of IPCC 2006 Guidelines.
Completeness	Emissions were estimated from synthetic nitrogen fertilizers and animal manure.
Major improvements since the last submission	The previous inventory did not have this category; thus, no recalculation was done.

Some agricultural activities add nitrogen to soils (such as the use of synthetic and organic fertilizers, deposited manure by grazing animals, crop residues, cultivation of organic soils, and mineralization of N in soil organic matter due to management of organic soils), thereby increasing the amount of nitrogen available for nitrification and denitrification, and ultimately the amount of N_2O emitted due to microbial process.

Agricultural soils contribute to GHG emissions through CO_2 emissions due to the loss of soil organic matter, CH4 from anaerobic soils such as rice paddies, and N_2O from fertilizer use and intensive cultivation. CO_2 emissions result from land-use change and are thus dealt with in the Land category. As alluded to above, fertilizer application and intensive cultivation are the fundamental practices and, ultimately, critical sources of N_2O emissions from managed soils in the country.

According to the IPCC (2006) Guidelines, several pathways of nitrogen inputs to agricultural soils can result in direct N_2O emissions, among them being synthetic nitrogen fertilizers, organic fertilizers (e.g., animal manure, compost, and sewage sludge), crop residue, and animal manure deposited on pastures, rangelands, and paddocks. The other indirect pathway is soil organic matter lost from mineral soils through land-use change and organic soil drained or managed for agricultural purposes.

Direct N_2O emissions from managed soils due to the total amount of nitrogen applied to soils through human-induced N additions and/or changes or practices are considered below. Specific N sources considered for estimating N_2O emission from managed soils for Seychelles are:

- Inorganic N Fertiliser

- Organic N fertiliser

2.25.2 Emissions

Direct N_2O emissions from managed soils from nitrogen inputs showed a reduction of -4.348 Gg CO2e between 2000 and 2020. This was from 10.354 Gg CO2e in 2000 to 6.006 Gg CO2e in 2020 (Table 2-69). This represented a -42.00 % decrease since 2000 (Figure 2-68).

Table 2. 69: Trend and relative contribution of direct N2O emissions from managed soils category between 2000 and 2020

Sub-category	Emissions (Gg CO_2e)		Change (2000 – 2020)	
	2000	2020	Difference (Gg CO_2e)	%
Direct N_2O from managed soils	10.354	6.006	-4.348	-42.00%

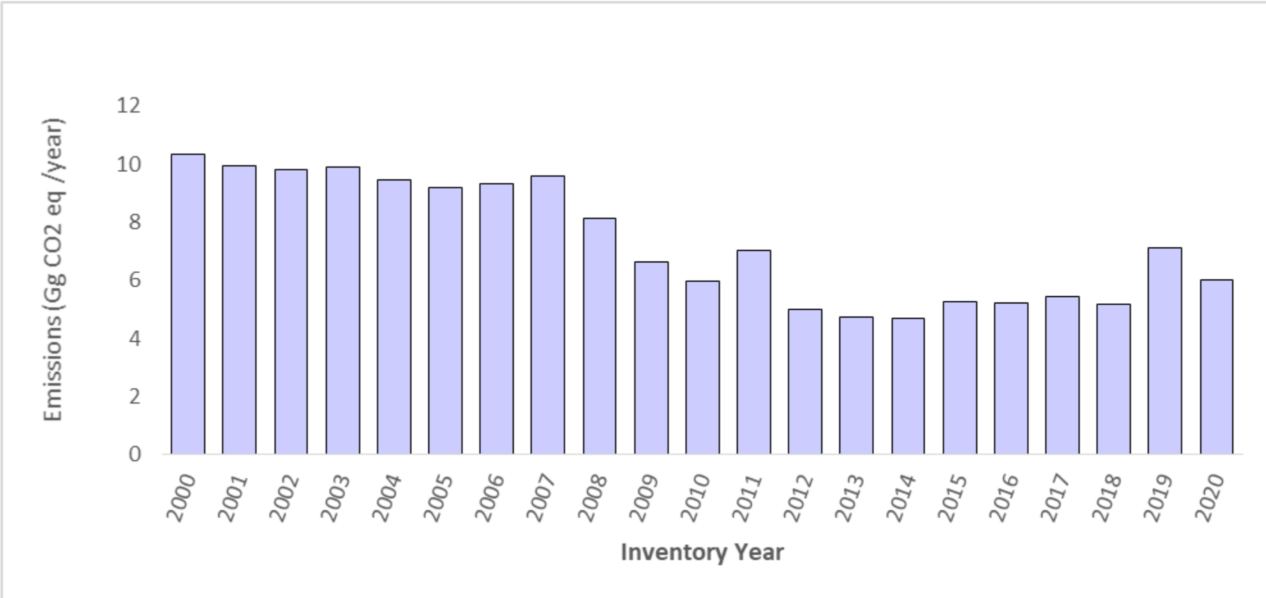


Figure 2-68: Direct N2O Emissions from managed soils (3.C.4), 2000-2020

2.25.3 Methodological Issues

The tier 1 method was used by applying Equation 11.1 of the IPCC 2006 Guidelines, with EF from Table 11.1. Organic fertilizers applied to soils were determined from Equations 11.3, 11.4, 11.5, and 11.7A of the IPCC 2006 Guidelines. Crop statistics were obtained from the FAO 2018 Annual Report, and crop residue factors were taken from Table 11.2 in the IPCC 2006 Guidelines. The amount of N mineralized in mineral soil due to loss of soil carbon through a change in land use was not included in this inventory due to a lack of data. However, since the land changes were incorporated, this factor can be included in the next inventory. Organic soils were also not included, as these were thought to be insignificant.

a. Activity Data and Emission Factors

National data on synthetic fertilizer application for 2000 to 2020 were collected from the National Bureau of Statistics (NBS, 2021), and the default emission factor was used for all sub-sectors to calculate Direct N2O emission from managed soils. The default emission factor was used from the 2006 IPCC Guidelines.

b. Fraction of N in Synthetic fertilizer:

Nitrous oxide emission from synthetic fertilizer was estimated based on the amount of N in the synthetic fertilizer used annually in the country. Data on the annual consumption of synthetic fertilizers were obtained from the yearly Farm Management Practice Report published by the National Bureau of Statistics (NBS, 2021). Data were gathered on the amount of synthetic fertilizer applied to the soils along with its N content for the period 2000 to 2020 (nitrogen amount from applied synthetic fertilizer for the year 2000 to 2020 was provided in the AFOLU data collection templates under 3C4 provided as part of this project.

c. Organic Nitrogen

Direct N_2O emission from organic nitrogen applied to managed soils was calculated using Equation 11.3 from the 2006 IPCC Guidelines. However, N2O emission was only calculated from the amount of manure applied to soils other than grazing animals because the application of compost and sewage was not that much practiced in the country. The amount of N in solid and liquid manure/slurry, which was annually used for crop fertilization, was calculated using Equation 11.4, and the amount of managed manure N available for soil application was estimated using Equation 10.34 from the 2006 IPCC Guidelines.

Due to the absence of country-specific emission factors to estimate Direct N2O emission from Managed soils, default emission factors from the 2006 IPCC Guidelines were sued and are presented below in Table 2-70.

Table 2. 70: Emission factors used to estimate Direct N2O emission from Managed soils

Emission factor for N_2O emissions from N inputs	kg N_2O-N (kg N input)-	2006 IPCC Guidelines
EF1 for N additions from mineral fertilizers, organic amendments and crop residues and N mineralized from mineral soil as a result of loss of soil carbon [kg N_2O–N (kg N)-1]	0.01	Table 11.1

2.25.4 Category-Specific QA/QC & Verification

Following EPA's QA/QC procedures, quality assurance and control forms were completed for the sector. Moreover, the inventory calculation files were exchanged with other sectors for QA/QC. National experts focused on the agriculture category, and consultants provided technical reviews and inputs into the sector’s inventory and even verified the calculation procedures applied.

2.25.5 Planned improvements

IPCC Land use category	Data gaps identified (AD and EF)	Planned Improvements /Remarks
Direct N_2O emissions from managed soils	i) Poor management systems and documentation of activity data on soil management, especially in rural areas	i) Development of management systems that should be fully documented by the Ministry of Agriculture ii) Accurate documentation of activity data on soil management by farmers and the Ministry of Agriculture iii) Development of country-specific emission factors for N_2O emissions from N inputs

2.26 Indirect N2O from manure management (3C6)

2.26.1 Category description

Emissions Sources	Indirect N_2O from manure management Livestock population
Gases Reported	Nitrous oxide (N_2O)
Methods	The tier 1 method was used, using Equation 11.9 and 11.10 of the IPCC 2006 Guidelines.
Emission Factors	Default EF from IPCC 2006 Guidelines (Table 11.3).
Key Category Analysis	Approach 1 in Vol. 1, Chapter 4 of IPCC 2006 Guidelines.
Completeness	Emissions were estimated from volatilization, runoff, and leaching from land where N was applied.
Major improvements since the last submission	The previous inventory did not have this category thus no recalculation was done.

IPCC Guidelines (2006) state that indirect emissions of N2O-N can take place through volatilization of N as NH3 and oxides of N, as well as through runoff and leaching from land where N was applied. This inventory estimated emissions from both ways, using livestock data from the Ministry of Agriculture. Expert judgment was used to establish manure management practices in the country through consultation with experts from the Ministry (e.g., extension officers).

2.26.2 Emissions

Emissions from indirect N2O from the manure management category decreased across the time series (Table 2-71 and Figure 2-69). In 2000, emissions from indirect N2O from manure management were at 1.340 Gg CO2e compared to 1.152 Gg CO2e in 2020. This represented a decrease of --14.012 % across the time series.

Table 2. 71: Trend and relative contribution of indirect N_2O from manure management between 2000 and 2020

Emissions (Gg CO_2e)		Change (2000 – 2020)	
2000	2020	Difference (Gg CO_2e)	%
1.340	1.152	-0.188	-14.012

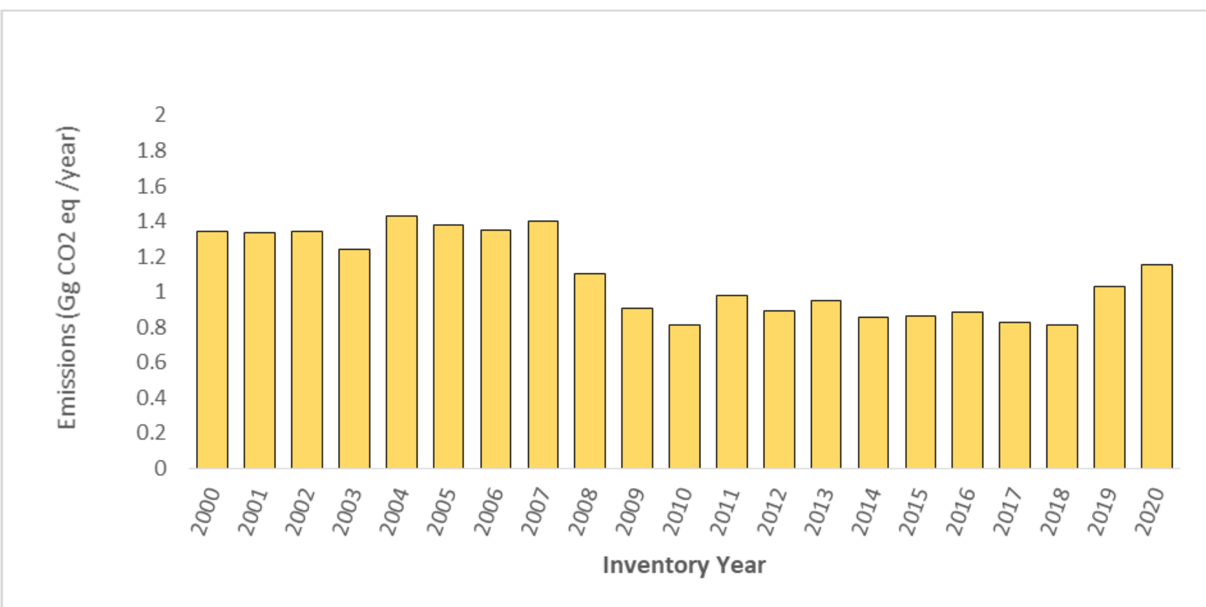


Figure 2-69: In-Direct N2O Emissions from manure management (3.C.6), 2000-2020

2.26.3 Methodological Issues

The tier 1 method was used to calculate the indirect nitrogen oxide (N_2O) emission from manure management, using Equation 11.9 and Equation 11.10 of the IPCC 2006 Guidelines, with EF from Table 11.3. Volatized N in the forms of NH_3 and NO_x were calculated for each manure management system from all livestock categories using Equation 10.26 according to the 2006 IPCC Guidelines. Final N_2O emissions were then estimated using Equation 10.27 (2006 IPCC Guidelines) (Eggleston et al., 2006), along with the default emission factors (Table 11.3, 2006 IPCC Guidelines).

a. Activity data and Emission Factor

The same activity data used in estimating direct N_2O emission were used to compute indirect N_2O emission from manure management. In contrast, the default emission factor (EF4) of 0.01 kg N_2O-N (kg NH_3-N + NO_x-N volatilised)-1 (Table 11.3) from the 2006 IPCC Guidelines was used.

For details on livestock numbers, the reader is referred to Section 5.2.2 (Enteric Fermentation). Additionally, management systems were solely obtained through expert judgment in consultation with experts in the field.

b. Time series consistency issues

According to the 2006 IPCC Guidelines, developing a time series of emissions estimates is a central component of the greenhouse gas inventory because it provides information on historical emissions trends and tracks the effects of strategies to reduce emissions at the national level. In the AFOLU sector, IPCC splicing techniques were used per the 2006 IPPC Guidelines to ensure time series consistency where data gaps existed.

In the agricultural sectors, gap-filling was conducted using some FAO data where necessary for animal population data. In the Land sector (3B), Wall-to-wall raster data on area and area changes were only available for 2000, 2015, and 2020. For missing years, an interpolation of an average of the areas had been converted to/from other land uses. Interpolation techniques were used to calculate the annual land use matrices and extrapolation. Surrogates were used to calculate the land area changes for the missing years, including the 1990 area change data. Similarly, in agriculture, there were some data gaps in livestock, and IPCC interpolation techniques were applied to fill the gaps.

c. Recalculations

No recalculations were performed as this was the first BUR reporting under the IPCC 2006 Inventory Guidelines during the inventory compilation process.

d. Category-Specific QA/QC & Verification

Following EPA's QA/QC procedures, quality assurance and control forms were completed for the sector. Moreover, the inventory calculation files were exchanged with other sectors for QA/QC. National experts and consultants provided technical review and input into the sector's inventory and even verified the calculation procedures applied.

2.26.4 Planned improvements

IPCC Land use category	Data gaps identified (AD and EF)	Planned Improvements /Remarks
Indirect N_2O from manure management	Poor management systems and documentation of activity data on manure management at the farm level	i) Development of management systems that should be fully documented at the farm level

2.27 Waste

2.27.1 Sector overview

Waste generation in Seychelles has been on the rise due to population growth, increased importation of goods, and tourism. The average population increase from 2000 to 2020 was 2.14% per annum. An average of approximately 62,085 tonnes of waste per year was generated over the period (LWMA,2021). This was projected to increase to 130.000 tonnes in 2035 (COWI, 2018). Approximately 95,000 tonnes of waste was generated in 2019 (LWMA,2021).

About 50% of the total amount of generated municipal solid waste was of an organic nature, which amounted to around 24,000 tonnes of organic waste generated each year (COWI, 2018).

The main driver for waste generation in Seychelles was the massive import of goods, especially the import of low-quality products with a short life span, as well as the lack of export of the related waste products, resulting in large waste stockpiles.

In 2020, Seychelles recorded 114,858 visitors, making tourism an essential contributor to waste generation. However, noting that COVID-19 impacted 2020, this figure was not representative of the typical visitor number. The annual increase in tourists from 2000 to 2019 was estimated at 9.79% (NBS), with 384,204 arrivals in 2019. The tonnage of waste arriving at the waste disposal facilities in 2020 decreased by 20.6% compared to 2019. This coincided with a 70.3% decrease in tourism arrivals related to the COVID-19 pandemic.

In 2019, bans were established to import certain types of single-use plastic items (e.g., plastic bags, styrofoam boxes, plastic utensils, cups, plates, and straws). There are currently four disposal sites in operation in the Seychelles: two on Mahé (Providence and Anse Royale), one on Praslin (Amitié), and one on La Digue (L'Union). The Ministry of Agriculture, Climate Change and Environment (MACCE) was charged with ensuring proper waste management and formulating policies and strategies for the sector.

2.27.2 Overview of waste sector GHG emissions in 2020

Methane (CH_4) and nitrous oxide (N_2O) were the leading greenhouse gases emitted from the waste sector in Seychelles. Emissions from the waste sector were estimated from Solid waste disposal (4A) and Domestic wastewater treatment and Discharge (4D) only. Precursor gases such as carbon monoxide (CO), nitrogen oxides (NOxs), sulphur oxides (SOx), and non-methane volatile organic carbons (NMVOCs) were not estimated due to activity data constraints.

In 2020, total GHG emissions were 60.467 GgCO2eq. The primary GHG emitted from waste was CH4, amounting to 59.356 GgCO2eq, with N2O emissions amounting to 1.111 GgCO2eq (Table 2-72).

Table 2. 72: Waste sector GHG emissions in 2020

Categories	Emissions [Gg]					
	CO_2	CH_4	N_2O	CH_4 in CO_2 eq	N_2O inCO_2 eq	Total CO_2 eq
4 Waste	**0**	**2.374**	**0.004**	**59.356**	**1.111**	**60.467**
4.A Solid Waste Disposal	**0**	**2.329**	**0**	**58.234**	**0**	**58.234**
4.A.1 - Managed Waste Disposal Sites				0	0	0
4.A.2 - Unmanaged Waste Disposal Sites				0	0	0
4.A.3 - Uncategorised Waste Disposal Sites				0	0	0
4.B Biological Treatment of Solid Waste		**0**	**0**	**0**	**0**	**0**
4.C Incineration and Open Burning of Waste	**0**	**0**	**0**	**0**	**0**	**0**
4.C.1 - Waste Incineration	0	0	0	0	0	0
4.C.2 - Open Burning of Waste	0	0	0	0	0	0
4.D Wastewater Treatment and Discharge	**0**	**0.0449**	**0.004**	**1.122**	**1.111**	**2.233**
4.D.1 - Domestic Wastewaster Treatment and Discharge		0.0449	0.004	1.122	1.111	2.233
4.D.2 - Industrial Wastewater Treatment and Discharge		0		0	0	0

4.E	**Other (please specify)**				**0**	**0**	**0**

2.27.3 Overview of waste sector methodologies and completeness

The 2006 IPCC Guidelines were used to estimate GHG emissions from waste. Calculations were conducted using the IPCC Inventory Software Version 2.91. Open burning of waste and industrial wastewater treatment and discharge were reported to be insignificant (COWI, 2018); hence, the emissions were not estimated (NE). Biological treatment of Solid Waste in Seychelles was not assessed because the plant has not been operational due to technical and economic reasons. DOC and nitrogen consumption were estimated based on population. Hence, precursors were not calculated.

Table 2. 73: Summary of methodologies for the Waste sector in 2020

Categories	Gg						
	CO_2	CH_4	N_2O	NOx	CO	NMVOCs	SO_2
4 - Waste	**0**	**1.994**	**0.004**				
4.A - Solid Waste Disposal	NA	1.951	0	NE EEA[2]	NE	NE	NA
4.A.1 - Managed Waste Disposal Sites							
4.A.2 - Unmanaged Waste Disposal Sites							
4.A.3 - Uncategorised Waste Disposal Sites							
4.B - Biological Treatment of Solid Waste		0	0	NE	NE	NE	NA
4.C - Incineration and Open Burning of Waste	0	0	0				
4.C.1 - Waste Incineration	0	0	0	NE	NE	NE	NA
4.C.2 - Open Burning of Waste	0	0	0	NE	NE	NE	NA
4.D - Wastewater Treatment and Discharge	0	0.044	0.004				
4.D.1 - Domestic Wastewater Treatment and Discharge		0.044	0.004	NE	NE	NE	NA
4.D.2 - Industrial Wastewater Treatment and Discharge		0		NE	NE	NE	NA
4.E - Other (please specify)				NO	NO	NO	NO

2.27.4 GHG emissions in CO2eq

The Global Warming Potentials (GWPs) from the IPCC Fourth Assessment Report (AR4) were applied in converting GHG from units of mass to CO2eq, and are shown in Table 2-74.

Table 2. 74: Global warming Potentials from the IPCC AR4

Name of gas	Chemical formula	GWP
Carbon dioxide	CO_2	1
Methane	CH_4	25
Nitrous oxide	N_2O	298

Source: IPCC, 2007

GHG emissions from the waste sector have risen from 28.66 Gg CO2eq in 2000 to 60.47 GgCO2eq in 2020 (Figure 2-70). Solid waste disposal (4D) by landfilling has been the primary source of emissions over the whole time series, accounting for 95% of the emissions from 2000 to 2020. The bulk of the emissions were from solid waste disposal (4A), contributing 96%, and domestic wastewater treatment and discharge (4D), accounting for 4% (Figure 2-71).

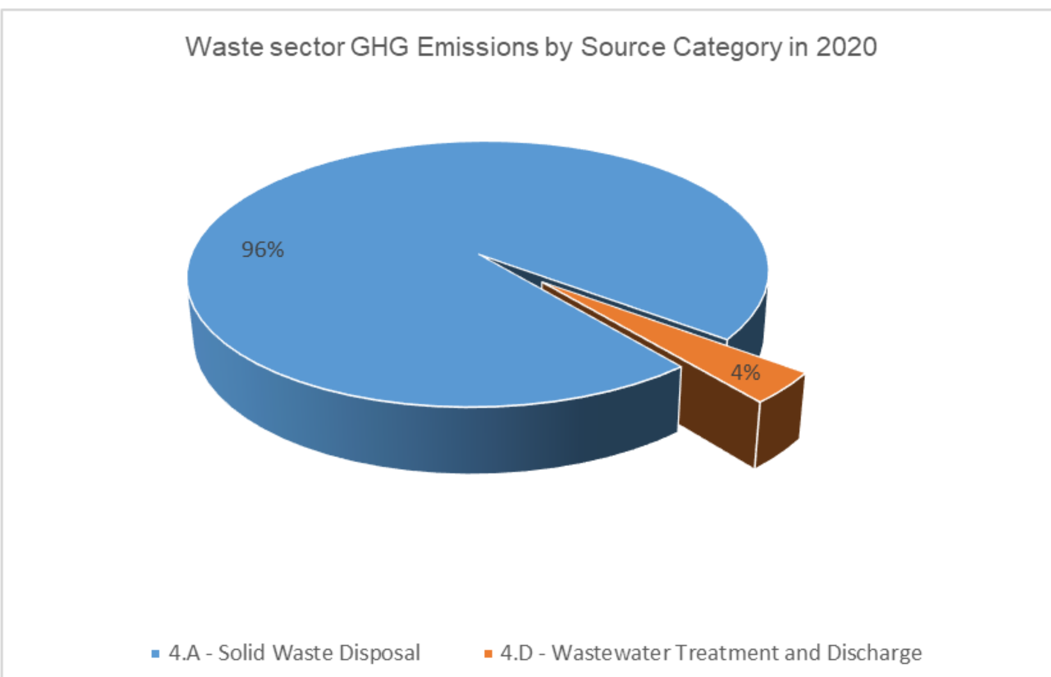


Figure 2-70: GHG emissions from Waste Sector by source category

The main gas emitted was CH4, accounting for 98%, with only 2% of the emissions coming from N2O (Figure 2-70).

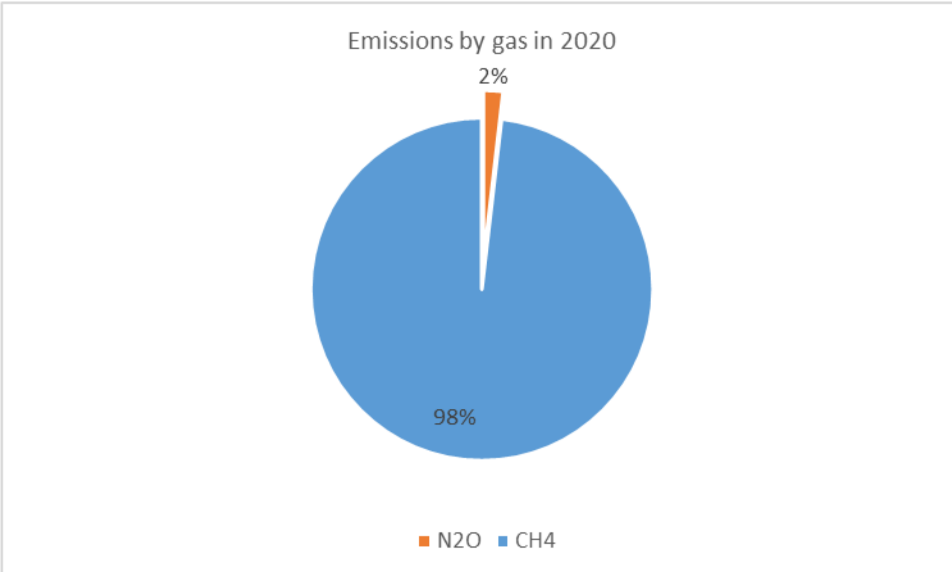


Figure 2-71: GHG emission by gas in 2020

2.27.5 Waste Sector GHG emissions trends

2.27.5.1 GHG trends by category

GHG emissions from the waste sector have risen from 28.66Gg CO2eq in 2000 to 60.47 GgCO2eq in 2020 (Figure 2-72). Solid waste disposal (4D) by landfilling has been the primary source of emissions over the entire time series, accounting for 95% of the emissions from 2000 to 2020. Domestic wastewater treatment and discharge (4D) contributed minor emissions at 5%. The growth in GHG emissions is related to the rising population and imports.

Figure 2-72: Waste sector emissions by sub-category, 2000-2020

CH4 emissions escalated from 1.110 Gg in 2000 to 2.374 Gg in 2020 (Figure 2-73). The consistent upward trajectory of the emissions culminated in a 114% increase in CH4 emissions from 2000 to 2020. The primary driver behind this increase in CH_4 emissions was the increased disposal of organic waste in landfills.

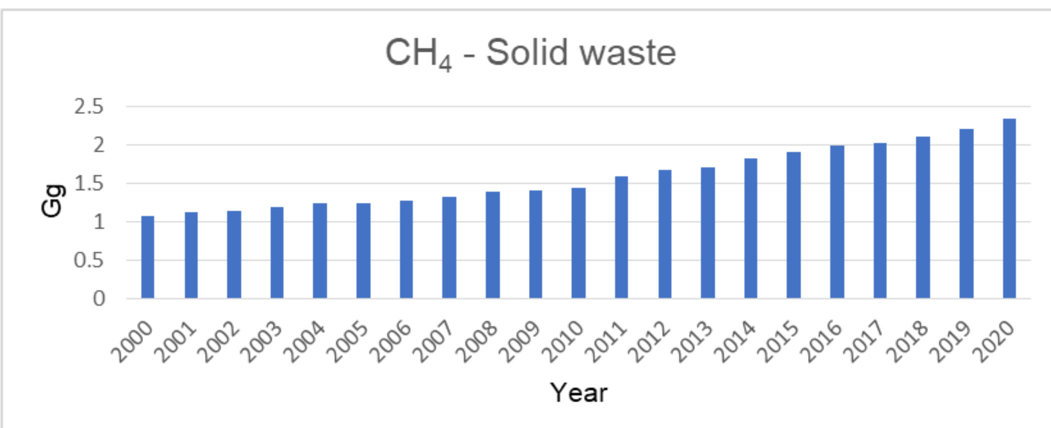


Figure 2-73: CH4 emissions from the Waste sector

The least emission by mass was N2O, rising slowly from approximately 0.003 Gg in 2000 to approximately 0.004 Gg in 2020 (Figure 2-74). The 21.4% increase in N2O emissions from 2000 to 2020 was primarily driven by population increase.

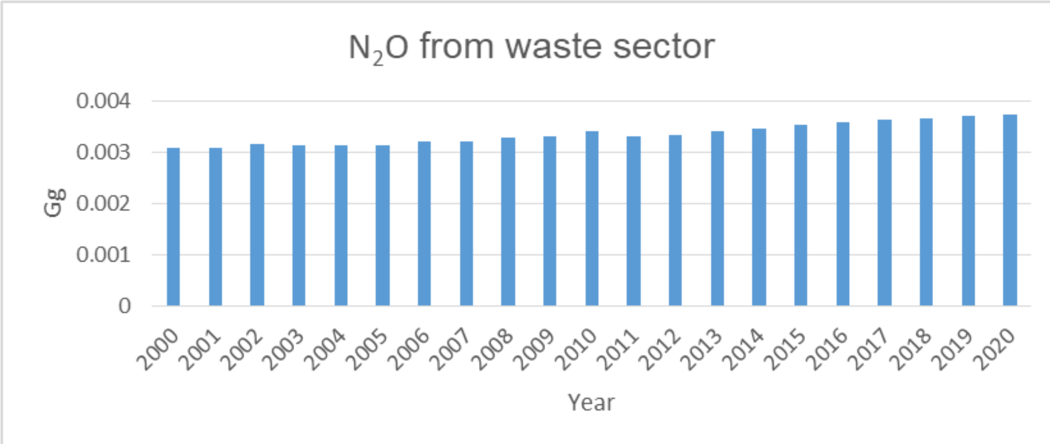


Figure 2-74: N2O emissions from waste sector

2.27.5.2 Overview of methodology and completeness

The 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for GHG inventory compilation were used to estimate GHGs from the waste sector. Default Methodology (Tier 1) was used for all the source categories. Table 2-75 summarizes the methodologies, activity data sources, and the categories reported in this inventory.

Table 2. 75: Summary of methodologies

Categories	Gg						
	CO_2	CH_4	N_2O	NOx	CO	NMVOCs	SO_2
4 - Waste							
4.A - Solid Waste Disposal		T1	NE				
4.A.1 - Managed Waste Disposal Sites							
4.A.2 - Unmanaged Waste Disposal Sites							
4.A.3 - Uncategorised Waste Disposal Sites							
4.B - Biological Treatment of Solid Waste	NE	NE	NE	NE	NE	NE	NA
4.C - Incineration and Open Burning of Waste	NE	NE	NE	NE	NE	NE	NA
4.C.1 - Waste Incineration	NE	NE	NE	NE	NE	NE	NA
4.C.2 - Open Burning of Waste	NO	NO	NO	NO	NO	NO	NA
4.D - Wastewater Treatment and Discharge							
4.D.1 - Domestic Wastewater Treatment and Discharge		T1	T1	NE	NE	NE	NA
4.D.2 - Industrial Wastewater Treatment and Discharge		NE		NE	NE	NE	NA
4.E - Other (please specify)				NO	NO	NO	NO

2.27.5.3 Solid Waste Disposal-4 A

The GHG emissions from solid waste in Seychelles comprised methane emissions from municipal solid waste disposal sites (SWDS), defined as unmanaged, shallow, and uncategorized, per the classification of 2006 IPCC Guidelines (IPCC, 2007). It was assumed that all solid waste in Seychelles was collected and disposed of at SWMS. There is neither waste separation at the SWDS) nor segregation at sources producing the waste.

Municipal solid waste was assumed to include household, garden, park, commercial and other waste. Total emissions were estimated per waste composition type using the degradable organic carbon content (DOC), the fraction of DOC dissimilated, the half-life, and a CH_4 generation rate constant, all supplied as regional default values in the IPCC Waste Model. The emissions from each waste type were then aggregated for a total emissions value.

CH_4 emissions escalated from 1.073 Gg in 2000 to 2.329 Gg in 2020 (Figure 2-75). The primary driver behind this increase in CH_4 emissions from solid waste disposal was the increase in organic waste disposal to landfills arising from an increase in population and level of consumerism.

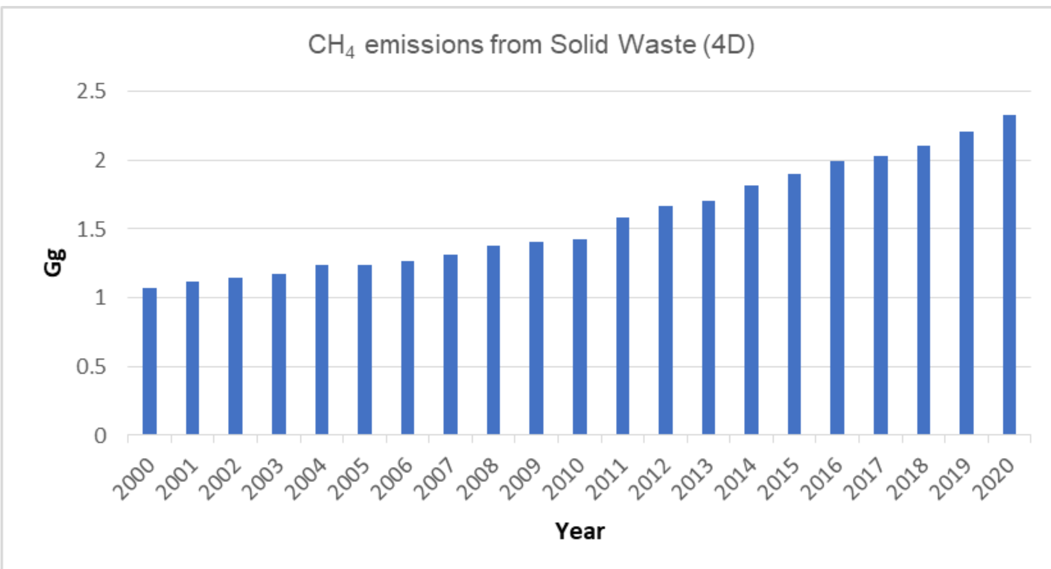


Figure 2-75: MSW Methane emissions trend (2000-2020)

a. Methodological issues

Estimation of CH4 emissions from solid waste was based on the 2006 IPCC Guidelines using a Tier 1 First Order Decay (FOD) method. The Solid Waste Masterplan for Seychelles (2020-2035) and the IPCC default values were used to determine parameters in the FOD model. The FOD method assumes that waste's degradable organic component (DOC) decays slowly throughout a few decades, during which CH_4 and CO_2 are emitted. Seychelles did not have a country-specific methodology for estimating emissions from solid waste handling; therefore, default parameters in the 2006 IPCC Guidelines were used where country-specific data were unavailable. The FOD equations 3.2 to 3.6 (2006 IPCC Guideline, Vol 5, Chapter 3) were used to estimate the methane emissions from solid waste.

b. Activity data

Table 2. 76: Estimated total solid waste generated (Gg)

Year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Waste	42.636	41.787	43.404	48.839	40.842	44.888	49.041	53.854	48.896	49.447
Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Waste	75.539	66.968	61.549	75.936	75.307	79.520	71.841	79.627	87.414	95.200
Year	2020									
Waste	71.272									

Table 2-76 presents the estimated total solid waste generated in Gigagrammes (Gg) for the years spanning from 2000 to 2020. Over the period from 2000 to 2019, solid waste generation showed a consistent upward trend. The overall increase in waste generation over the period was approximately 61.16%, which is equivalent to approximately 3.36% per annum.

A decrease in waste generation observed in 2020 could be attributed to the profound impact of the COVID-19 pandemic. The pandemic brought about disruptions in various sectors of society, including tourism and commercial activities, subsequently reducing the waste production.

c. Emission Factors

Methane Correction Factor (MCF)

The estimation of MCF values was based on the weighted average, considering the distribution of MSW flows into uncategorized and shallow landfills. The default MCF is 0.4 and 06 for unmanaged shallow (<5m waste) and uncategorized, respectively, were used (IPCC, 2007). The weighted MCF was 0.58.

Waste Composition and DOC

Waste composition in the IPCC Guidelines is shown in Table 2-77.

Table 2. 77: Waste composition

Waste Type	Proportion in waste (%)
Food	18
Garden	10
Paper	11
Wood	0
Textile	5
Plastics	56

Degradable Organic Carbon (DOC)

DOC is the portion of organic carbon in solid waste susceptible to biochemical decomposition. Default values for DOC in different waste types are given below in Table 1 5, provided in Volume 5, Chapter 2, Table 2-78.

Table 2. 78: Default values for DOC in different waste types

Waste Type	DOC values
Paper and Cardboard	0.40
Textiles	0.24
Food waste	0.15
Garden and Park Waste	0.20
Wood and straw	0.43
Disposable nappies	0.24

Source: (IPCC, 2007)

Fraction of Degradable Organic Carbon which Decomposes (DOCf)

A fraction of DOCf default value of 0.5 in the 2006 IPCC Guidelines (Vol.5, Chapter 3, Page 3.13) was used.

Constant k and half-life t1/2

The half-life value is the time taken for the DOCm in waste to decay to half its initial mass. The constant k is related to t1/2 by the equation:

$k = \ln(2)/t_{1/2}$

Equation 1 1: Relationship between half-life and reaction rate constant

Source: (IPCC, 2006)

For Seychelles, in the tropical dry zone, default k and t1/2 are shown in Table 1 6 as provided by the 2006 IPCC Guidelines, Vol 5 Chapter 3, Tables 3.3 and 3.4.

Methane recovered R

There is mostly no methane recovery for flaring or energy use at the landfills in Seychelles. The default value of R = zero was used (2006 IPCC Guidelines (Vol. 5, Chapter 3) was, therefore, used

Oxidation Factor (OX)

The default value for OX of zero, according to the 2006 IPCC Guidelines (Volume 5, Chapter 3, Table 3.2), was used.

2.27.5.4 Domestic Wastewater Treatment and Discharge- 4 D 1

Methane and nitrous oxide emissions from the treatment and discharge of liquid wastes and sludge from housing and commercial sources through wastewater sewage collection and treatment systems, pit latrines, and discharged into surface waters are covered in this section. A tier 1 approach was used for all categories in the wastewater category (4D) due to limitations in country-specific activity data. Only wastewater from the domestic sector was considered, as no heavy industries were present in Seychelles. Total GHG emissions from wastewater treatment increased from 1.840 Gg CO2eq in 2000 to 2.233 Gg CO2eq in 2020 (Figure 2-76).

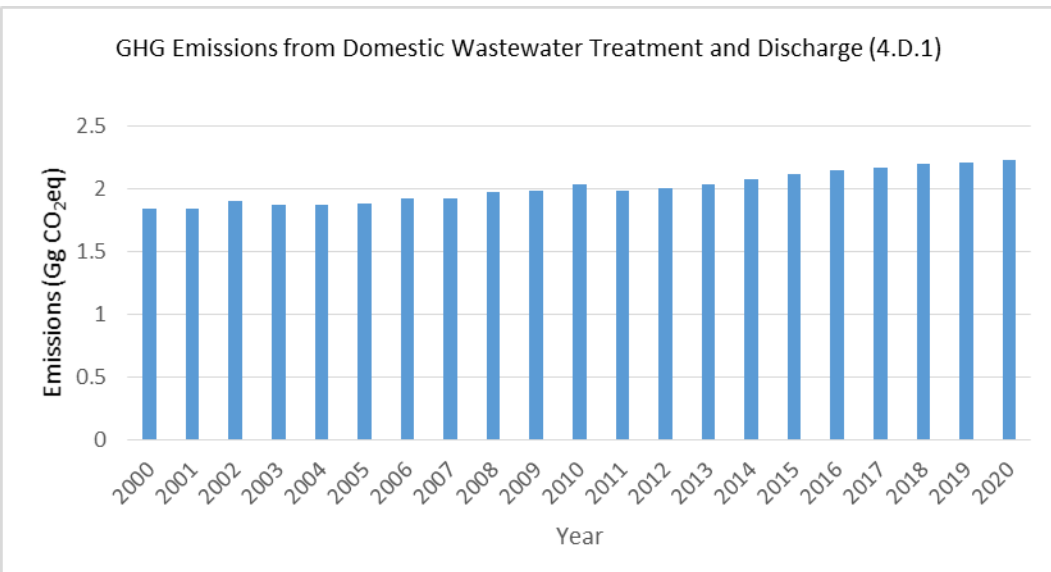


Figure 2-76: Emissions from Domestic wastewater treatment and discharge

GHG emissions from domestic wastewater have been steadily rising, characterized by a few spikes, from 2000 to 2020, in line with population growth Figure 83.

a. Methodological issues

The Tier 1 methodology was applied, following the Decision Tree for CH4 emissions from domestic wastewater (Figure 6.2, in Chapter 6, Volume 5 of the 2006 IPCC Guidelines). The Tier 1 method applies default values for the emission factor and activity parameters. This method is considered good practice for countries with limited data, as was the case for Seychelles in the TNC.

b. Activity data

The quantity of domestic wastewater generated was estimated based on the population. Default parameters from the 2006 IPCC Guidelines were used (Table 2-79). The degradable organic component -BOD was 13.505 kgBOD/cap/yr, while the correction factor for industrial BOD discharged in sewers was 1.25.

c. Emission Factors and parameters

Table 2. 79: Default Emission factors were obtained from the IPCC Guidelines (IPCC, 2007).

Parameter (units)	Value
Emission Factor (kg N_2O-N/kg N)	0.005
Fraction of industrial and commercial co-discharged protein (Find-com) (-)	1.25
Fraction of nitrogen in protein (Fnpr) (kg N/kg Protein)	0.16
Degradable organic component – BOD [kg BOD/cap/yr] (rural and urban)	13.505
Maximum methane-producing capacity – B0 [kg CH_4/kg BOD] (Centralized, aerobic treatment plant, Latrine, Septic system)	0.6
Nitrogen removed with sludge (N sludge) (kg)	1
Fraction of non-consumption protein (Fnon-con) (-)	1.1
Fraction of Population Income Group – Ui [Fraction] Rural Urban high income Urban low income	 0 0.5 0.5
Per capita protein consumption (Protein) (kg/person/Year)	21.9
Emissions from Wastewater plants (Default value is zero (0)) (kg N_2O/yr)	0
Degree of utilization – Tij [Fraction]	

Income Group	**Type of treatment or discharge pathway**	**Value**
Rural	Centralized, aerobic treatment plant	0
Rural	Latrine	0
Rural	Septic system	0
Urban high income	Centralized, aerobic treatment plant	0.5
Urban high income	Latrine	0
Urban high income	Septic system	0
Urban low income	Centralized, aerobic treatment plant	0.5
Urban low income	Latrine	0
Urban low income	Septic system	0

d. Time series consistency

The activity data for the whole time series was, while for all the years, tier 1 methodology was used.

e. Category-specific QA/QC and Verification

Calculations were performed in spreadsheets to check if the activity data and parameters were correctly entered into the IPCC Inventory Software.

f. Category-specific Recalculations

There were no recalculations since this category was not reported in previous national communications.

2.27.5.5 Long-term carbon storage from the waste sector

Some carbon will be stored in SWDS over long time periods (Figure 2-77). Wood and paper decay slowly and accumulate in the SWDS (long-term storage). Carbon fractions in other waste types decay over varying periods.

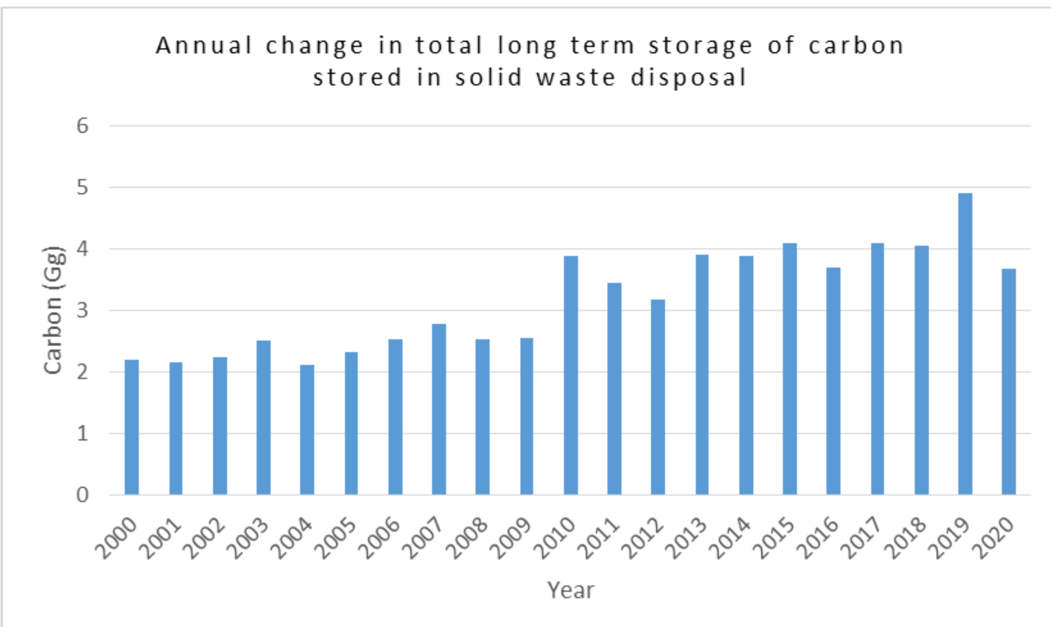


Figure 2-77: Long-term carbon capture and storage from waste

2.27.6 Uncertainty analysis

AD uncertainty was not available; hence, uncertainty analysis was not performed.

2.27.7 Quality assurance and quality control

Table 2. 80: QA/QC procedures implemented in the Waste Sector

Data Type	QA/QC procedure	Remarks/Comments/Examples
Activity data check Calculation by the approved 2006 IPCC software	Check for transcription, typographical errors, and errors of transposition.	Division of tasks among the inventory team to ensure that one or two members of the team always focus on double checking and ensure that data errors associated with those described in the left column are avoided.
	Comparison with published data/literature	Data on per capita solid waste generation and fraction of waste composited and incinerated were cross-checked with published figures from the NBS.
	Consistency checks of categories and sub-categories with totals	Ensuring that disaggregated figures at the category and sub-categories levels add up to the overall totals.
	Identify and fix outliers in data inputs (including checking for dips and spikes in the trend)	Data that deviate unrealistically from the trends and spikes beyond ranges are suspected as inaccurate and replaced with a figure using expert judgment.
	Documentation of all data sources, data format and assumptions for easy reference	A record of all data, their sources and assumptions made in admitting the data use were kept. This helped in easy cross-referencing.
	Ensure reduction in data clumsiness or data redundancy	Logical sequence data flow according to the IPCC methodology for the GHG emission estimation was designed for: • easy understanding and further probing of how the final results in the IPCC software would look like. • easy cross-referencing and avoidance of mistakes, • easy transmission into the IPCC software. • aid in better interpretation of the implication of the use of the data.
	Cross-check all steps involved in the calculation.	Ensure that steps used for determining, estimating and deriving data are accurate, transparent internally consistent.
	Documentation of sources and correct use of units.	Use of the documentation template records for all data sources and assumptions.
	Check for transcription, typographical errors and errors of transposition.	Check mistakes and blunders in the data entry into the software.
	Checked completeness of data coverage.	Ensuring all the relevant gases for the specific activity were covered.

Data Type	QA/QC procedure	Remarks/Comments/Examples
Results (emissions)	Check for recalculation differences.	To identify and pinpoint changes, revision and reallocation to improve accuracy and transparency of the estimates
	Identify and fix outliers in the results	Check for dips and spikes in trends and levels
Documentation	Assumptions, corrections, data and sources.	Ensure consistency, transparency, facilitate repeatability and easy retrieval
	Improvement list (internal and external findings)	Help prioritise areas that require actions.

2.27.8 Time series consistency issues

The 2006 IPCC Guidelines were used to calculate GHG emissions for all the years. Activity data for solid waste quantities for the period 2000 to 2020 were obtained from STAR Seychelles (2000-2009) and the Landscape and Waste Management Agency (LWMA) (2010 onwards).

Activity data from solid waste management for the period 2017 to 2018 were not available. A splicing technique was used to estimate waste activity data for this period.

2.27.9 Recalculations

In the previous National Communication (NC), the landfill in Seychelles was characterized as a shallow, unmanaged landfill. However, in the current report, it has been recognized that this definition does not align with the criteria provided in the IPCC Guidelines. Consequently, to calculate the greenhouse gas (GHG) emissions arising from solid waste, the conversion rate associated with managed landfills as per the IPCC Guidelines was adopted. This adjustment reflects the understanding that the operation of the landfill in Seychelles more closely aligns with the definition of a managed landfill than that of an unmanaged shallow landfill.

2.27.10 Planned improvements

Table 2. 81: Planned Improvements

Gap or constraint	Planned improvement	Timing
Default parameters on solid waste were used	Analyze waste category data from LWMA weighbridge to determine waste generation quantities, composition, and waste streams	October 2024

Collection of data was difficult due to lack of a system for collecting, transmitting waste data	Establish a comprehensive waste sector activity data collection and transmission system	June 2024
Lack of historical activity data and parameters	Enhance the inventory archiving system	October 2025
Uncertainty analysis was not performed due to lack of data	Collaborate with data providers to obtain uncertainty estimates when data are submitted	June 2024
Activity data were not available from 1990 to 2000	Initiate data collection efforts for the period dating back to 1990	June 2024
The landfill has low compaction, which can inhibit methane production	Recalculate solid waste emissions to consider the impact of low compaction.	October 2025

CHAPTER 3 MITIGATION ACTIONS AND THEIR EFFECTS

3.1 Overview

As per the guidance established by Decision 2/CP17, Annex III, this report provides information on the actions by Seychelles to mitigate climate change by addressing anthropogenic emissions.

Mitigation actions are not limited to those communicated officially to the United Nations Framework Convention on Climate Change (UNFCCC) and compiled in document FCCC/SBI/2013/INF.12/Rev.2. However, the Nationally Appropriate Mitigation Actions (NAMAs) that were initially communicated under the Copenhagen Accord already cover an extensive range of different approaches and types of actions that can be envisioned.

Depending on the focus of the analysis, mitigation actions can be grouped in different ways.

The most common classifications are by:

- Type of action: here, the main question is what type of action is the focus of the mitigation action, i.e., which instruments are used as mitigation actions;
- Scope: another dimension is the coverage of the mitigation action by sector, geography, or technology;
- Source of funding: if the source of financing is the dominant question, a different classification will result.

Different classifications of mitigation actions will be suitable depending on which of these categories or combinations of categories are explored. The subsequent section provides some further details of the various approaches to differentiating the mitigation actions mentioned above.

As per the 2021 NDC and based on current projections, the Seychelles aims to reduce overall GHG emissions by 26.4% in 2030 compared to Business as Usual (BAU) (equivalent to around 293.8 ktCO2eq of avoided emissions). Compared to the 2015 INDC target of 188ktCO2eq GHG emissions reduction, the mitigation ambition of the Seychelles is significantly enhanced. The mitigation actions provided are in accordance with the commitments in the Seychelles' Nationally Determined Contribution submitted in 2021. In addition, Seychelles has committed to aiming to achieve a decarbonized net-zero emission economy by 2050.

This report provides the details concerning mitigation actions for the Seychelles in the 4 IPCC sector categories: energy sector (including transport) and non-energy sectors (Industrial

Processes and Product Use (IPPU); waste; Agriculture, Forestry, and Other Land Use (AFOLU)). The mitigation actions are provided in tabular format and are organized according to the sectors.

3.2 Introduction

Seychelles is a Small Island Developing State (SIDS) under the Non-Annex 1 category of countries country classification by the United Nations Framework Convention on Climate Change (UNFCCC). In alignment with the UNFCCC and Article 2, paragraph 1 of the Kyoto Protocol, Seychelles is committed to engaging and driving climate change counter-actions through its recently submitted and updated Nationally Determined Contribution (NDC) 2021. Seychelles aims to quantify its emission limits and reduce GHG emissions to promote sustainable development and minimize anthropogenic activities' social, environmental, and economic impacts.

Following Seychelles' Third National Communication (TNC) submitted in December 2023, this chapter on Mitigation provides an update over the last nine years on actions that the Government of Seychelles (GoS) has undertaken to implement the Paris Agreement (PA). This chapter reviews the climate change counter-actions and their effects on the mitigation measures implemented or drafted over the last decade.

One of the key focus areas of this mitigation chapter is to understand the national government's policies and strategies to help implement climate change mitigation. These policies' analyses focus mainly on the energy sector, as per the last national communication report, which showed that the energy sector contributed to over 95% of the national greenhouse gas (GHG) emissions. The Energy Policy 2010-2030 is purposely designed to achieve the expected outcomes and its national potential for reducing GHG. Other polices come from the Seychelles Government's agencies, organizations, or departments, such as the Departments of Climate Change, Agriculture, Forestry and Land Use, and Waste Management, along with policies from cross-cutting sectors such as Tourism, Health, Education, Disaster Management and the Blue Economy were also analyzed with respect to climate change mitigation. This chapter will also conclude with the status of national GHG emissions and removals by sinks, as well as the actions required to enhance and reduce the sinks.

In 2019, Seychelles submitted a request to the NDC Partnership for assistance in updating its NDC as required by the Paris Agreement (PA). However, due to the COVID-19 pandemic, this was delayed. Seychelles received assistance from four partners (IRENA, the World Bank, the European Union (EU), and the United Nations Development Programme (UNDP) to assist in this exercise. Three other partners (GIZ, SeyCCAT, and PEW) also contributed to this exercise. In July 2021, Seychelles communicated its updated NDC to the United Nations Framework Convention on Climate Change (UNFCCC). The Seychelles' commitment to reducing its GHG emissions is reflected in its updated NDC and is as follows:

The Republic of Seychelles is committed to reducing economy-wide absolute GHG emissions by 293.8 kt CO2e in 2030 (26.4%) compared to the BAU scenario.

With its newly proposed enhanced mitigation contributions, Seychelles seeks to achieve a considerable mitigation benefit, reducing GHG emissions to 817 kt CO2e by 2030 relative to baseline emissions. This will also impart a lasting adaptation impact on energy and water security for Seychelles and improve resilience across communities.

The enhanced mitigation contributions include:

- The 2030 commitment to reduce economy-wide GHG emissions by 26.4% below business-as-usual (BAU);
- The long-term commitment to achieve a decarbonized economy by 2050 and to boost electricity generation from renewable energies, including marine energy technologies, bio-energies, such as biomass and waste-to-energy, and the use of environment-friendly intermittent energy storage technologies;
- The 2030 commitment to shift progressively to low-carbon transport, including active modes and international maritime transport, starting with public transportation;
- The 2030 commitment to use renewable energy (RE) for water supply mobilization and to secure a sustainable and resilient water management system;
- The 2030 commitment to ensure that sewage systems and wastewater treatment facilities include nutrients and energy recovery;
- The commitment to ensuring Responsible Tourism in a circular economy, defining a 2030 target of reducing GHG emissions from the sector.

Seychelles supports the use of all of the enhanced ambition instruments under Art. 6 of the PA, focusing on energy and mobility under the provision of cooperative approaches (Art. 6.2 PA) and on targeting adaptation benefits for rural communities (food and water security and healthy soils) as well as interventions on sustainable tourism and blue habitats (ecosystem services from coastal wetlands and marine resources) under the non-market approaches provision (Art. 6.8 PA). The intervention areas are:

1. Reducing energy intensity and fostering energy efficiency;
2. Increasing renewable energy targets;
3. Lowering the carbon intensity of mobility;
4. Shifting towards responsible tourism and the circular economy.

3.3 Approaches used for mitigation assessments

Mitigation assessments can be made based on a combination of three alternatives, namely: (i) a project- or activity-based approach, (ii) an outcome-based approach, or (iii) a combination of the two. These types of mitigation actions, known as 'contribution type,' are depicted in Figure 3-1.

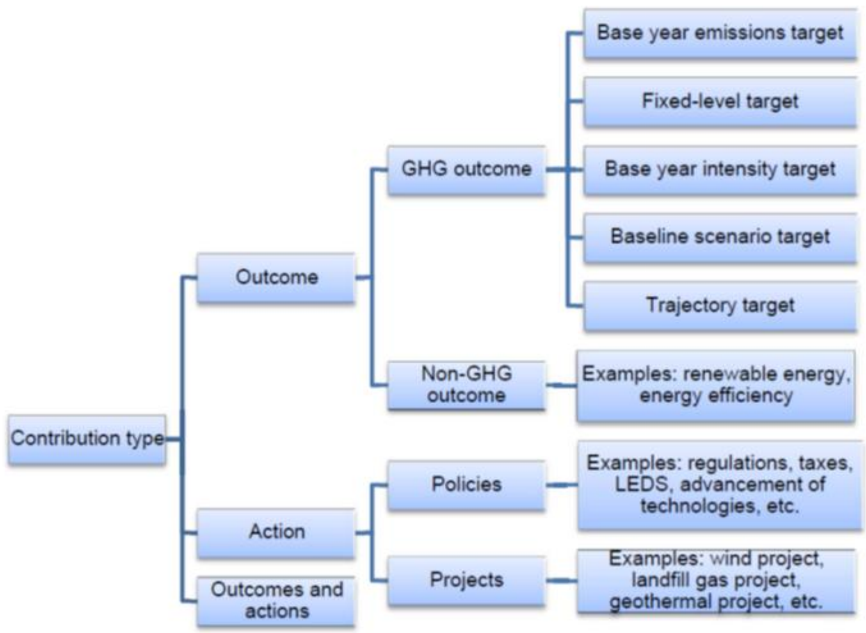


Figure 3. 1: Different types of mitigation actions

Source: WRI & UNDP, 2015

In the mitigation analyses, both activity-based (bottom-up) and outcome-based (top-down) approaches have been adopted. The overall level of GHG emission reductions or sequestration has been calculated by developing business-as-usual sectoral baseline scenarios or when policies would be hindered due to prevailing barriers. The use of baseline scenarios to calculate the emission reduction accruing from mitigation actions is illustrated in Figure 3-2.

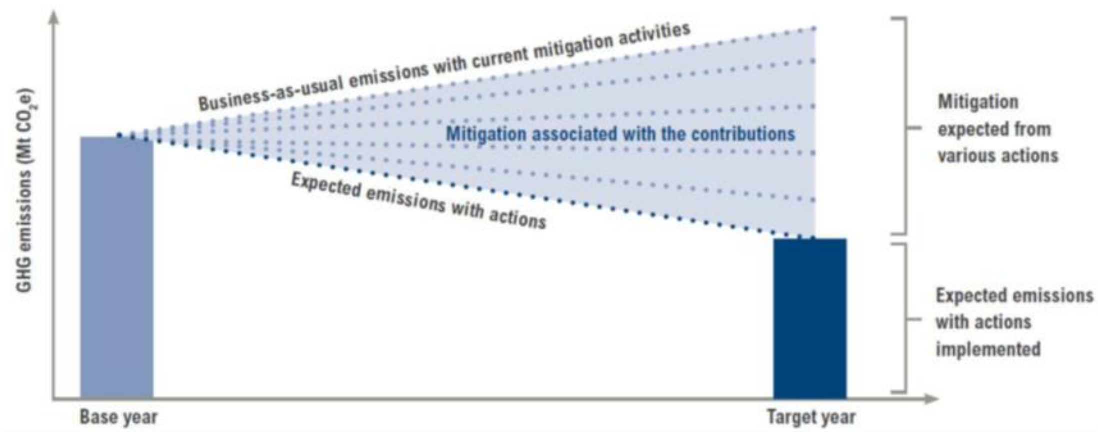


Figure 3. 2: Assessing the emission reduction potential of actions using the baseline scenario approach

Source: WRI & UNDP, 2015

3.4 Mitigation actions in the energy sector

3.4.1 Introduction

Seychelles has adopted several mitigation actions in the energy sector to reduce the country's dependency on fossil fuels. Three mitigation actions are ongoing in the energy sector, including increasing the contribution of renewable energy in the energy mix, implementing energy efficiency measures, and decarbonizing the transport sector. All three mitigation actions are being implemented at the national level and aim to reduce imported fossil fuel consumption in Seychelles.

3.4.2 Policies, strategies, and schemes

This section lays out the energy sector's past and ongoing policies, strategies, and schemes. These measures are considered in the respective mitigation actions.

3.4.3 Renewables energy generation

The 2009 Energy Policy of the Republic of Seychelles, 2010 – 2030, sets specific targets for the increase in renewable energy’s contribution to the power sector. These targets are 5% by 2020 and 10% by 2030. The policy promotes the integration of renewable energy, particularly photovoltaic (PV) systems, and since late 2013, the integration of grid-connected PV generation systems has progressed rapidly. The energy policy is being revised with updated targets for renewable contribution and energy efficiency. The updated target will align with the conditional target laid out in the Seychelles' updated National Determined Contribution (NDC), which states that by 2030, the contribution of renewable energy to the national electricity generation will reach 15%.

Following the establishment of the Seychelles Energy Commission in 2010, the Energy Act of 2012 was enacted, and roles were assigned. With the new Electricity Bill of 2022, more regulations have been passed to regulate the power sector, including generating electricity from renewable energy sources.

Several schemes, policies, and programs are in place to support the installation of PV systems. The net metering program allows for connecting solar PV systems to the grid. The net-metering program enables electricity consumers to inject electricity from their PV systems into the national grid. The units of electricity generated from the PV system are then subtracted from the customers' electricity bill. The program limits the size of residential PV systems only to generate 100% of their electricity consumption. Commercial customers are limited to 50% of their average electricity consumption. If the power supplied to PUC exceeds the energy consumed, PUC will purchase it at a rate equivalent to 88% of fuel costs. PV integration has progressed rapidly for commercial customers as they have higher electricity tariffs than residential electricity consumers.

To further improve the viability of installing PV systems, the net-metering program was supported by two other financing mechanisms: a low-interest rate loan and a rebate scheme. The low-interest loan scheme called the Seychelles Energy Efficiency and Renewable Energy Programme (SEEREP) has been established to help cover the costs of installing energy-efficient and renewable energy equipment. A rebate scheme to cover the initial investment cost of PV systems was introduced using financing from the GOS-UNDP-GEF project named the Grid-Connected Rooftop Photovoltaic Systems Project. Upon completion of the project, the rebate scheme ended.

In terms of utility-scale projects, several renewable energy projects have been developed with grants and low-interest loans. These include a 6 MWp wind farm and two solar farms with a cumulative capacity of 5 MWp. Additionally, a 3.4 MWh Battery Energy Storage System has been installed to manage the balance of power from renewable energy sources.

3.4.4 Energy efficiency

Similar to renewable energy efficiency is addressed and promoted in the Energy Policy of the Republic of Seychelles, 2010 – 2030. Although various measures were proposed by the Seychelles Energy Commission (SEC), specific targets were not defined in the energy policy. With the revision of the energy policy, a new target of 15.5% by 2030 in energy efficiency improvement is being proposed in comparison to the business-as-usual scenario. This target is reflected in the Seychelles' updated NDC.

As per the Energy Act, the Seychelles Energy Commission is responsible for promoting the adoption of energy efficiency measures and advising the ministry responsible for energy on developing policies related to energy efficiency. In addition, the GOS-UNDP-GEF project named the Promotion and Up-scaling of Climate-resilient, Resource-efficient Technologies in a Tropical Island Context Project aimed to increase market penetration of energy-efficient technologies. The project undertook several activities to promote energy efficiency, particularly in the electricity sector, such as raising public awareness of the benefits of undertaking energy efficiency measures and undertaking a light-emitting diode (LED) bulb exchange campaign. Additionally, Seychelles has implemented tax exemptions on imported renewable energy technologies and energy-efficient appliances.

3.4.5 Transport

The Energy Policy of the Republic of Seychelles, 2010 – 2030, outlined a plan to decrease oil imports for transportation purposes from 15% to 30% by 2030. This goal would be achieved through various measures, such as increasing the use of electric vehicles, improving fuel efficiency, and promoting low-carbon fuels. The updated National Determined Contribution has reinforced this objective and aims to reduce greenhouse gas emissions by 30% by 2030 compared to the business-as-usual scenario.

The development and approval of the GEF project titled: 'Support the Shift to Electric Mobility in Seychelles'. The project aims to accelerate the share of electric mobility in Seychelles, particularly in public transportation, while also developing adequate electric mobility policies and financing concepts. In the public transport sector, the People's Republic of China has committed to donating 22 electric buses to the Government of the Seychelles.

To incentivize the adoption of less polluting vehicles in the transport sector, the government of Seychelles has put tax incentives in place for hybrid and electric vehicles. Although the tax incentives can vary for hybrid cars, depending on the size and power of the vehicles, 100% of the excise tax is exempted for electric cars. However, through the GEF project, Seychelles aims to expedite the introduction of electric mobility in the country.

3.4.6 Mitigation action details

The mitigation actions in the energy sector are organized in two tables. The first table describes the national measures that aim to reduce emissions by increasing the contribution of renewables in the power sector. The second table details the action to reduce GHG emissions by promoting energy efficiency measures. The approach taken to define the mitigation actions is to meet the sector-wide targets defined in either the revised energy policy or the updated NDC. Each mitigation action, therefore, encompasses several measures in the sector. This approach was taken as often the individual measures do not quantitatively meet targets. The same approach was applied to define the mitigation actions in the transport sector.

Table 3. 1: Mitigation Action 1 – Energy Sector

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Increasing the contribution of renewable energy in the Seychelles' electricity generation mix	On-going	Seychelles’ Energy Commission, Ministry of Agriculture, Climate Change and Environment, Public Utilities Corporation	2010-2030	Energy - Electricity Generation	National	2020 Target: 5% renewable energy contribution, which amounts to an annual GHG emission reduction of 8 $ktCO_2e$ in 2020 compared to the baseline emission. 2030 Target: 15% renewable energy contribution, which amounts to an annual GHG emission reduction of 61 $ktCO_2e$ in 2030 in comparison to the baseline emission.	CO2
	The objective of the mitigation action						
	The mitigation actions aim to meet the renewable energy targets laid out in Seychelles' energy policy. The 2009 Energy Policy is being revised with updated targets for renewable energy contribution and energy efficiency. The updated target will align with the conditional target laid out in Seychelles’ updated National Determined Contribution, which states that by 2030, the contribution of renewable energy to the national electricity generation will reach 15%. To achieve this target, several measures are laid out in the mitigation description to promote the use of solar and wind. These measures involve creating an enabling regulatory environment and upgrading the national grid to absorb and manage the new variable energy generation additions.						
	Brief description and activities planned under the mitigation action						

	Measures implemented - Set up institutional and regulatory framework; - Formulate the Energy Policy with set targets for renewable energy contributions in 2020 and 2030; - Energy Act enacted; - Set up the Seychelles' Energy Commission; - Put into place incentive schemes and the Port Victoria Wind Farm (2010-2015, completed); - The GEF-UNDP-GoS project activities including national coordination, pilot solar PV project, resource assessment, financial rebate schemes, and capacity building; - 6 MW Port Victoria Wind Farm commissioned in 2013; - Introduce the Net metering programme for residential and commercial solar PV systems; - The Seychelles Energy Efficiency & Renewable Energy Programme (SEEREP) - Conduct studies, grid expansion projects, deployment of utility-scale PV systems and battery storage (2015- 2022, completed) - 6 MW Utility solar PV System on Ile de Romainville; - 33 kV South Mahé transmission line extension project; - 1 MWh battery storage system; - 6 MW cumulative rooftop solar PV system. Planned measures - Continue solar PV system deployment to reach energy policy target; - Continue PV rebate scheme; - 4 MW floating solar PV system (first IPP project); - Support from the Sustainable Renewables Risk Mitigation Initiative (SRMI) Facility to install 18 MW of solar PV and 18 MWh of storage; - New projects are planned for agri-voltaic, floating solar, mounted, and rooftop PV installations. The projected capacity expected in the near-medium term is 36 MW solar PV and 44 MWh BESS.
	Estimated outcomes and estimated emission reductions
	In 2020, the goal was to achieve a 5% share of renewable energy in the total electricity mix, representing an annual reduction of 7.8 thousand tonnes of CO_2e emissions compared to the baseline scenario. In 2030, the target is to achieve a 15% contribution of renewable energy in the national electricity mix. This amounts to an annual decrease in 61 thousand tonnes of CO_2e emissions compared to the baseline scenario. These targets are aligned with the overarching NDC target to transition to a net-zero economy by 2050.
	Methodologies and Assumptions
	The methodology for calculating the emission reduction is the CDM methodology AMS-I.D - Grid-connected renewable electricity generation,

	which applies to the installation of a greenfield plant that supplies electricity to a national grid. The emissions from the business-as-usual scenario (baseline emission) are the product of the electricity generated from the cumulative solar and wind electricity generation from the mitigation action and the grid emission factor. As per the methodology, deploying solar and wind-generated energy in the mitigation action does not generate any emissions. As prescribed by AMS-I.D methodology, the emission factor of the electricity system is calculated using the "Tool to calculate the emission factor for an electricity system". In the business-as-usual scenario, it is assumed that there are no deployments of renewable energy technologies made from 2010 to 2030 in Seychelles. Assumptions: - The mitigation action's geographical scope is undertaken on the three main islands, Mahé, Praslin, and La Digue which have a national electricity grid operated by the Public Utilities Corporation; - The renewable energy capacity is replacing the energy that would have been generated by the Public Utilities Corporation's diesel generator. - The grid emission factor calculated for 2022 is used to calculate the emissions from electricity consumption for the years after 2022; - Without the implementation of the mitigation action, there would not be any solar PV or wind projects implemented. - In the mitigation actions scenario, the increasing share of electricity contribution from renewables is assumed to be linear from 2022 onwards to meet the 2030 target. - The electricity demand is projected to have a linear increase of 6% in the business-as-usual scenario and the mitigation action scenario.						
General description of the monitoring and reporting system							
Name of the indicator	Unit	Indicator baseline value	Indicator target value	Year baseline and target value related to	Indicator value in the last reporting year	Reporting year	Most relevant data sources for indicator value
	Progress indicators						
Renewable energy installations	MW	0	36	2030	19	2022	PUC
	Indicators related to the GHG impacts						
Annual emission reduction	$ktCO_2$	0	61 $ktCO_2$	2030	15 $ktCO_2$	2022	Seychelles' Energy Commission

Table 3. 2: Mitigation Action 2 – Energy Sector

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Implementation of energy efficiency measures	On-going	Seychelles' Energy Commission, Ministry of Agriculture, Climate Change and Environment, Seychelles Planning Authority, Minister of Lands and Housing	2010-2030	Energy – Energy Efficiency	National	2030 Target: 15.5% energy efficiency improvement compared to the BAU scenario, which amounts to an annual reduction in GHG emissions of 60 ktCO2e in 2030 compared to the baseline emission.	CO2
	The objective of the mitigation action						
	The mitigation action on energy efficiency builds on the measures mentioned in the revised energy policy targets. It aims to achieve an energy efficiency target of 15.5% by 2030, relative to the business-as-usual scenario. This mitigation action is a conditional target included in the Seychelles' updated National Determined Contribution. The mitigation action focuses on the building sector, with various measures such as setting up the regulatory framework and introducing various energy efficiency incentives and programs considered. The mitigation action description provides the details of the individual measures and the phase-wise implementation.						
	Brief description and activities planned under the mitigation action						

	Implemented measures - Set up institutional and regulatory framework (2010): - Energy Policy; - Energy Act enactment; - Set up the Seychelles Energy Commission. - Implement awareness campaigns and set up incentives: - National energy efficiency awareness campaigns; - National LED lightbulb campaign; - The Seychelles Energy Efficiency & Renewable Energy Programme (SEEREP); - Tax incentives for energy-efficient appliances; - Smart metering pilot project, measuring energy consumption at higher temporal resolution; - Define targets for the energy efficiency sector communicated in the Seychelles' updated Nationally Determined Contribution. Planned measures - Revise energy policy with set target for 2030 communicated in the Seychelles' updated Nationally Determined Contribution; - Enact the Utilities Regulatory Commission; - Expand the regulatory framework to enforce energy efficiency; - Promote cold storage energy efficiency projects; - Establish and enforce minimum energy performance standards; - Tax incentives extended on more energy-efficient appliances; - Continue the SEEREP scheme (low-interest loan scheme); - Tariff reform, in combination with the adoption of smart meters; - Allocate responsibility to the entity to promote energy efficiency measures; - Efficient cold storage projects in large-scale applications (including in food processing, hotels, and supermarkets); - Implement Building Energy Management System to promote energy efficiency measures in commercial and industrial buildings; - Increase insulation in buildings to reduce cooling demand in new and existing buildings; - Use alternative cooling technologies (including solar and geothermal).
	Estimated outcomes and estimated emission reductions
	By 2030, the aim is to achieve a 15.5% improvement in energy efficiency compared to the business-as-usual scenario. This would result in an annual reduction of 60 thousand tonnes of carbon dioxide equivalent in 2030 compared to the baseline scenario.
	Methodologies and Assumptions

	The methodology for calculating the emission reduction is the CDM methodology AMS-II.E. - Energy efficiency and fuel switching measures for building, Option 1 s. As per the methodology, the emission factor of the electricity system is calculated using a “Tool to calculate the emission factor for an electricity system.” Although AMS-II.E recommends using the combined margin, the "Simple Operating Margin" was used due to a lack of data. The emission reduction calculation considers the cumulative impacts of the individual action mentioned in the mitigation action description. Assumptions: - The emission reduction only includes emission reduction from the decrease in electricity demand achieved in buildings from the individual actions relative to the business-as-usual scenario; - It is assumed that the buildings implementing the mitigation actions only consume electricity from the national grid and do not utilize captive power plants; - The mitigation actions are undertaken on the three main islands, Mahé, Praslin, and La Digue, which have a national electricity grid operated by the Public Utilities Corporation; - The emission reduction from energy efficiency will linearly increase from 2023 to the target set in 2030; - The grid emission factor calculated for 2022 is used to calculate the emissions from electricity consumption for the years after 2022; - The electricity demand is projected to have a linear increase of 6% in the business-as-usual scenario and the mitigation action scenario.						
General description of the monitoring and reporting system							
Name of the indicator	Unit	Indicator baseline value	Indicator target value	Year baseline and target value related to	Indicator value in the last reporting year	Reporting year	Most relevant data sources for indicator value
	Progress indicators						
Energy consumptions reduction	GWh	0	90	2030	0	2022	PUC
	Indicators related to the GHG impacts						
Annual emission reduction	$ktCO_2$	0	61 $ktCO_2$	2030	0 $ktCO_2$	2022	Seychelles’ Energy Commission

Table 3. 3: Mitigation Action 3 – Transport Sector

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Decarbonising the transport sector	On-going	Seychelles' Energy Commission, Ministry of Agriculture, Climate Change and Environment, Seychelles Public Transport Corporation	2010-2030	Transport	National	2030 Target: 30% reduction in GHG emission from the transport sector (gasoline vehicles) relative to business-as-usual, which amounts to an annual reduction in GHG emissions of 29 thousand tCO_2e in 2030. 2030 Target: 50 tCO_2e annual emission reduction from introducing electric buses.	CO_2
	The objective of the mitigation action						
	The mitigation action in the transport sector is to promote the use of electric vehicles, with specific goals set for adopting electric vehicles within both the passenger and public transportation sectors. These targets aim to increase the overall usage of electric cars and reduce the reliance on traditional internal combustion vehicles. The Energy Policy of 2009 laid out a potential to reduce oil imports for transport purposes by 15% to 30% or more by 2030 through a collection of measures, including increasing the share of electric cars, improving fuel efficiency, and using biofuels. This objective has been reaffirmed and concretized in the updated National Determined Contribution, which aims to achieve a 30% GHG emission reduction in 2030 relative to the business-as-usual scenario. In addition, the mitigation action accounts for the emission reduction achieved by implementing the Support the Shift to Electric Mobility in the Seychelles GEF project and donating electric buses from the People's Republic of China.						
	Brief description and activities planned under the mitigation action						

Implemented measures

- Energy Policy
- Set up incentives and setting-up national coordination:
- Tax incentives to increase the number of hybrid and electric vehicles in the national passenger fleet (2015).
- Development and approve the GEF project titled: Support the Shift to Electric Mobility in the Seychelles. The project aims to accelerate the share of electric mobility in Seychelles, particularly in public transportation, while also developing adequate electric mobility policies and financing concepts (2021);
- Set targets for the transport sector in the Seychelles' updated Nationally Determined Contribution.

Planned measures-

- Expand the regulatory framework, incentives, and national infrastructure:
- Accept the donation of 22 electric buses from the People's Republic of China to the Government of the Seychelles;
- GEF project titled: Support the Shift to Electric Mobility in the Seychelles implementation;
- Utilize the donation of electric buses as a demonstration project to collect the necessary information to make informed decisions when up-scaling the number of electric buses in public transportation;
- Increase the number of electric vehicle charging stations nationally.

Estimated outcomes and estimated emission reductions

The first expected outcome of this mitigation action is to reduce greenhouse gas emissions in the transport sector by 30% relative to the baseline scenario. This amounts to an annual reduction of 28 ktCO_2e in 2030 compared to the baseline scenario. This reduction will be achieved by increasing the share of electric vehicles (EVs) in the national passenger vehicle fleet. EVs offer a cleaner and more efficient alternative to conventional cars that run on fossil fuels and emit greenhouse gases. The second expected outcome is the increase in the share of electric buses in the Seychelles Public Transport Corporation (SPTC) fleet to 50%.

Methodologies and Assumptions

The CDM methodology for calculating the emission reduction is AMS-III.C.- Emission reductions by electric and hybrid vehicles.

Assumptions:

- In the mitigation action scenario, the number of electric passenger vehicles will linearly increase from 2023 to the target set in 2030;
- The share of electric buses in the SPTC fleet will linearly increase from 2023 to the target set in 2030;
- In the business-as-usual scenario, it is assumed that there is no adoption of electric vehicles;
- The electric vehicles are charged using electricity from the national grid;
- The grid emission factor calculated for 2022 is used to calculate the emissions from electricity consumption for the years after 2022 for both the mitigation action scenario;
- In the mitigation action scenario and the business-as-usual scenario, the fuel consumption of passenger vehicles is assumed to be 7 liters

	per 100 km from 2010 until 2023, which gradually linearly decreases to 6 liters per 100 km in 2030;						
General description of the monitoring and reporting system							
Name of the indicator	Unit	Indicator baseline value	Indicator target value	Year baseline and target value related to	Indicator value in the last reporting year	Reporting year	Most relevant data sources for indicator value
	Progress indicators						
Number of electric vehicles	#	0	27,000 passenger vehicles and 130 electric buses	2030	365 passenger vehicles and 0 electric buses	2022	Seychelles Licensing Authority
	Indicators related to the GHG impacts						
Annual emission reduction	$ktCO_2$	0	28 $ktCO_2$	2030	0.4 $ktCO_2$	2022	Seychelles' Energy Commission

3.5 Trend analysis of the mitigation actions

The greenhouse gas emission trend for each sector is graphically represented below. The two scenarios presented in each graph are the business as usual/baseline scenario and the mitigation action scenario. The timeframe for which the two scenarios are calculated is between 2010 to 2050. The business-as-usual scenario assumes the absence of mitigation actions. The mitigation action scenario reflects the progress achieved from 2010 to 2022 in emission reduction and the expected emission reductions through measures implemented after 2022. It is important to note that the mitigation actions are considered in isolation from each other. For example, the increase in renewable energy contribution does not consider improving energy efficiency in the power sector.

3.5.1 Trend analysis of the renewable energy generation mitigation action

The GHG emission trends from the baseline and mitigation action scenario for mitigation action of increasing the contribution of renewable energy are displayed in Figure 3.3. As per the historical trend, electricity generation is expected to continuously increase. This is reflected in the linear increase in GHG emission increase in the BAU scenario. In the mitigation action scenario, although electricity generation increases the contribution of renewable energy sources in the electricity mix, it slows down the rate of GHG emissions to flatten before 2050.

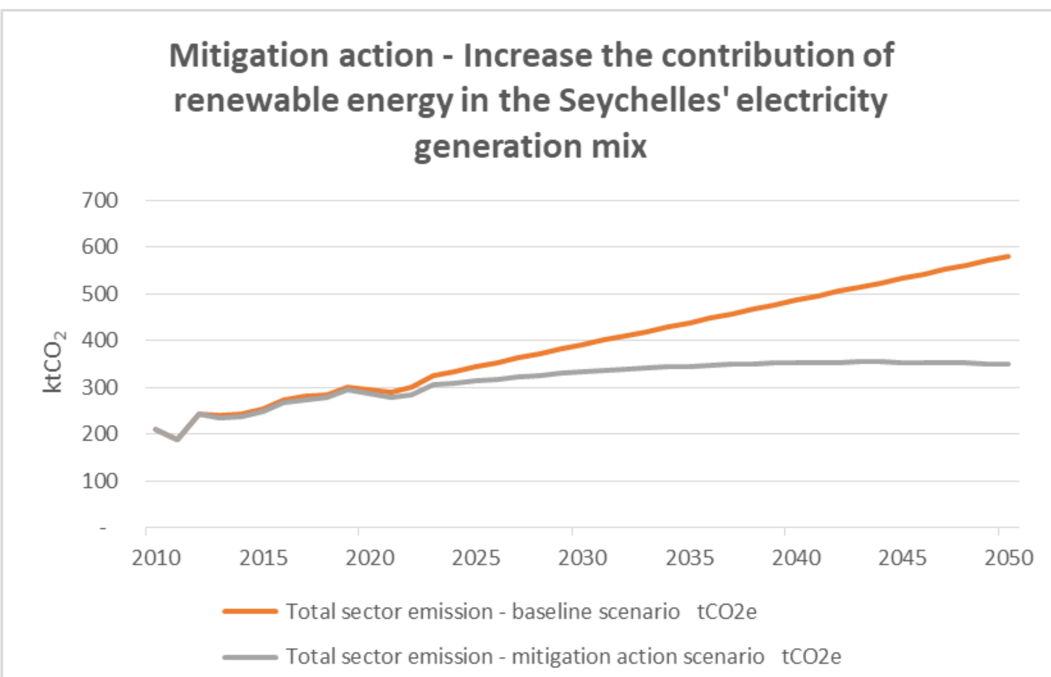


Figure 3. 3: Greenhouse gas emission trend of scenarios used to calculate the emission reduction from mitigation action 1 (2010 - 2050)

3.5.2 Trend analysis of the energy efficiency mitigation action

The GHG emission trends from the baseline and mitigation action scenario for mitigation action of increasing energy efficiency are displayed in Figure 2. Similar to mitigation action 1, the measures in mitigation action 2 target the reduction of GHG emissions from electricity consumption. Without energy efficiency measures, the emission linearly increases with the increase in electricity demand. The implementation of measures in mitigation action two results in a gradual decrease in the growth rate of emissions from the power sector, with emissions even decreasing shortly after 2035 (Figure 3-4).

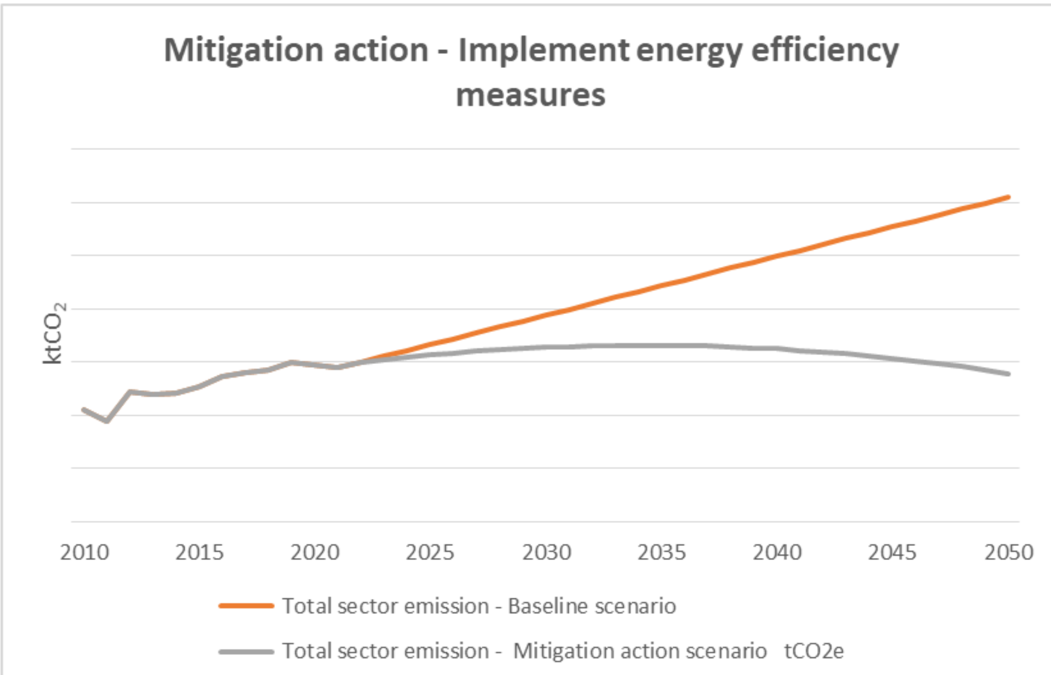


Figure 3. 4: Greenhouse gas emission trend of scenarios used to calculate the emission reduction from mitigation action 2 (2010 - 2050).

3.5.3 Trend analysis of the transport sector mitigation action

The GHG emission trends from the baseline and the mitigation action scenario for mitigation action to decarbonize the transport sector are displayed in Figure 3-5. The difference between the baseline scenario and the mitigation action scenario prior to 2022 is similar due to the limited number of measures in the transport sector. The divergence commences after 2022 with an increase in the rate of electric vehicle adoption. In the mitigation action scenario, by 2030, all passenger vehicles will be electrified, and therefore, after a gradual decrease in emissions before 2030, emissions will begin to increase with the continuous increase in passenger vehicles in the country. As each mitigation action is modeled in isolation, the potential increase in renewable energy contribution is not reflected in this mitigation action scenario. Therefore, in a scenario where the renewable energy contribution targets are achieved in the power sector, the emission reductions from adopting electric vehicles in the transport sector will increase.

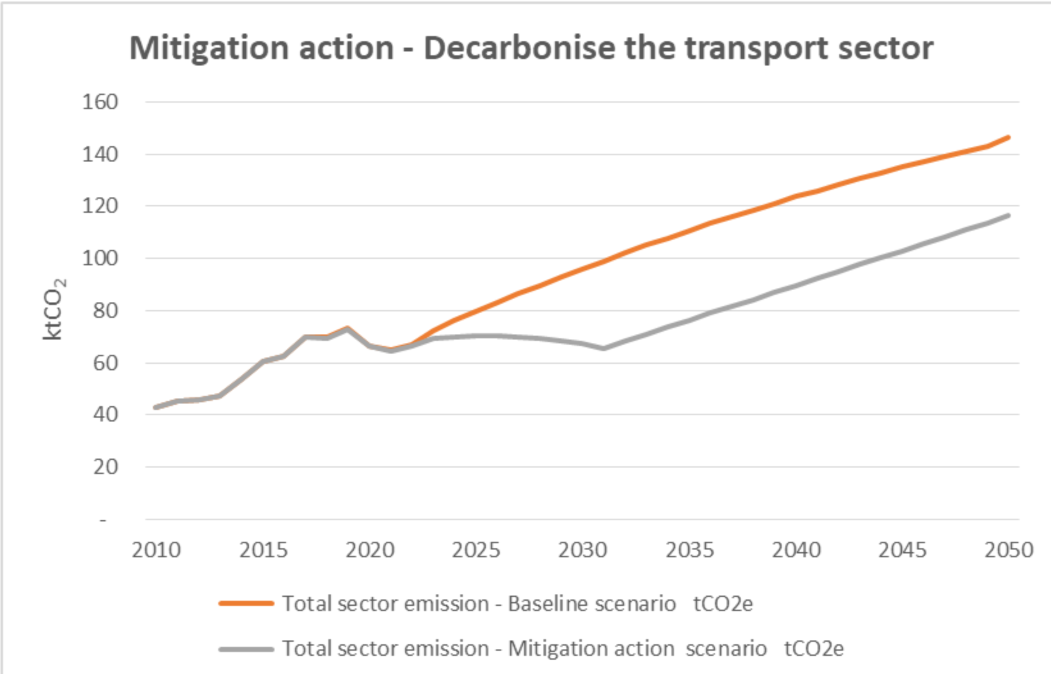


Figure 3. 5: Greenhouse gas emission trend of scenarios used to calculate the emission reduction from mitigation action 3 (2010 - 2050).

3.6 Data monitoring and reporting

3.6.1 Data monitoring and reporting for the renewable energy generation mitigation action

The monitored parameters for the mitigation action are per the CDM methodology AMS-I.D Grid connected renewable electricity generation.

The CO_2 emission factor of the grid electricity.

The grid emission factor is calculated by the Public Utilities Corporation annually. The calculation currently utilizes an internal method and does not align with the CDM tool “Tool to calculate the emission factor for an electricity system.”

Quantity of net electricity generation supplied by renewable energy plants

For certain renewable energy plants, the electricity supplied must also be measured in addition to the electricity provided by the plant. To date, all renewable energy generation systems connected to the national grid have a separate electricity meter. The values are recorded monthly by the Public Utilities Corporation and reported annually to the Seychelles Energy Commission.

Currently, there are no biomass power plants in Seychelles. However, if such a plant is deployed, additional parameters would need to be monitored, such as the quantity of biomass consumed, the biomass's moisture content, and the biomass's net caloric value.

3.6.2 Data monitoring and reporting for the energy efficiency mitigation action

The monitored parameters for the mitigation action are per the CDM methodology AMS-II.E Energy efficiency and fuel switching measures for buildings.

Electricity consumed by the baseline and project building

The electricity consumption of all buildings is recorded monthly by the Public Utilities Corporation.

The CO_2 emission factor of the electricity consumed

The mitigation action assumes that the national grid only supplies the buildings. In the case that the building has a captive power plant, the emission factor, that is, the CO2 emission factor of that building from electricity consumption, would need to be calculated.

Average technical transmission and distribution losses for consuming electricity

The average technical transmission and distribution losses are calculated by the Public Utilities Corporation and reported to the Seychelles Energy Commission.

Gross floor area of the project building unit for each building unit category

The National Planning Authority provides the gross floor area of all new buildings. A compilation of the floor areas of all Seychelles buildings is currently unavailable. The floor area and the building category defined in the methodology would need to be provided for each building involved in the mitigation action.

Average yearly operating hours of the institutional building unit

In the situation in which an institutional building is considered in the mitigation action, the annual average operating hours would need to be monitored.

Average yearly occupancy

When surveys are conducted to monitor the mitigation action, the average yearly occupancy rate of the buildings is to be recorded.

As the mitigation action only considers energy efficiency improvements from electricity consumption in buildings, the consumption of other energy sources and their related parameters are not considered, for example, in the use of LPG for cooking purposes.

3.6.3 Data monitoring and reporting for the transport sector mitigation action

The monitored parameters for the mitigation action follow the CDM methodology AMS-III.C Emission reductions by electric and hybrid vehicles.

Annual average distance driven by project vehicle

The average distance is currently not recorded at the national level. A representative value could be determined from a survey of vehicles for each vehicle category to determine this parameter.

Average technical transmission and distribution losses for providing electricity

It is assumed that the electricity used to charge electric vehicles would be taken from the national grid. Therefore, the average technical transmission and distribution losses calculated by the Public Utilities Corporation and reported to Seychelles' Energy Commission would be utilized.

The CO2 emission factor of the electricity consumed

The mitigation action assumes that the electric vehicles are only charged using electricity from the national grid. Therefore, the national grid emission factor is used.

Number of project vehicles in operation

Currently, the type of vehicles is recorded nationally during the registration of new cars. The National Bureau of Statistics (NBS) reports presently on the number and type of cars registered annually. However, the NSB does not have electric vehicles as a type of vehicle in its reporting.

Specific electricity consumption per km per project vehicle category

Similar to the average distance traveled, the particular electricity per km is not monitored at the national level. Therefore, this parameter could be determined using a representative value assessed from a survey of vehicles for each vehicle category.

Electricity consumed by the project vehicle

The electricity consumption of electric vehicles could be monitored using records from charging stations. It is assumed that only electric cars would be promoted in the mitigation action. Therefore, monitoring parameters related to the fossil fuel consumption of project vehicles are not considered.

3.7 Mitigation actions in the IPPU sector

3.7.1 Introduction

The Industrial Processes and Product Use (IPPU) Sector in Seychelles is mainly comprised of the service sector, with tourism and fisheries as the main national economic sectors. The cooling, refrigeration, and air-conditioning (RAC) sector dominates the IPCC category. The National Ozone Unit of the MACCE, in collaboration with other stakeholders, has been very active under the Montreal Protocol in phasing out the import of conventional refrigerants like CFCs, HCFCs and the eventual phase-down of HFCs as per the Kigali Amendment to the Montreal Protocol. These refrigerants are both global warming and ozone-depleting substances. The import of CFCs was banned entirely in 2005, and the total phase-out was in 2007. HCFCs have been phased out under the Hydro chlorofluorocarbons Phase-Out Management Plan (HPMP) (2011-2025).

Additionally, with the ratification of the Kigali Amendment in 2019, Seychelles will soon embark on formulating an HFC Phase-down Management Plan (KIP). HFCs fall into another class of refrigerants that are global warming gases and were introduced as transition products to replace CFCs and HCFCs. The mitigation potential for the RAC sector is that the alternatives to these conventional refrigerants, namely hydrocarbons, carbon dioxide, and ammonia, in addition to being climate and ozone-friendly, are also energy-efficient. A summary of past actions taken and the course of actions for the RAC sector are as follows:

3.7.2 Projects carried out to phase out Chlorofluorocarbons (CFCs)

- Country Programme: The main achievement of the Country Programme has been the elimination of 0.93 Ozone Depleting Potential (ODP) tonnes in the aerosol and domestic refrigerator manufacturing sectors in the late 1990s.
- Countrywide survey on the supply-demand scenario of Ozone Depleting Substances (ODS) use.
- Analysis of future requirements and the limits imposed by the Protocol.
- Assessment of options available for changing over to alternative technologies and substances in each sector and sub-sector.
- Assessment of the actions to be undertaken to implement phase-out of CFCs.
- The ban on imports of all CFC-based appliances has been in place since 1999, and HCFCs have been in place from 2010 to 2018.
- The institution of an import licensing system for controlling the import of CFCs/HCFCs.
- The ban on imports of halons.
- Constitution of a steering committee with representation of all concerned ministries to guide the phase-out process
- Refrigeration Management Plan: Phase out the use of CFCs in the servicing and maintenance of refrigeration equipment.
- Training in good practices (Trainers, refrigeration technicians, and customs officials).

- Recovery and recycling of CFCs.
- Initiation of legislative measures.
- Conversion projects, including retrofitting (2012)
- Hydrofluorocarbon Phase-out Management Plan: Achieve complete phase-out of CFCs and HCFCs by the provisions of the Montreal Protocol through strict control, monitoring, and gradual reduction of imports of the ozone-depleting substances (ODS) as well as appliances containing ODS. Customs officers and technicians were also trained in hydrocarbon technology.
- Several legislation measures have been put into place to control ozone-depleting substances (ODS), and these are:
- The Consumer Protection Regulations 1999:
- The Environment Protection Act, Part IV 1995: Control of imports of all equipment/ appliances containing controlled refrigerants
- Environment Protection (Ozone) Regulations 2000 for the control & phase-out of CFCs
- Environment Protection (Ozone) Regulations 2010 for the control & phase-out of HCFCs
- S.Is 6,7,8,9,40 of 2021 for the phase-down of HFCs

3.7.3 Projects carried out under the HPMP to phase out Hydrochlorofluorocarbons (HCFCs)

- Institutional setup – coordination by the (Landscape?) Solid Waste Management Agency of the Ministry of Agriculture, Climate Change and Environment
- Legal framework
- Public and private sector participation
- The HCFC policy instrument serves to control the import of HCFCs through a quota system and the imposition of a ban on the import of all HCFC appliances as of 2010;
- Intensive awareness raising by the National Ozone Unit (NOU) of the Ministry of Agriculture, Climate Change and Environment.
- Training in the technical and enforcement fields (e.g., training of trainers, provision of equipment to training institutions, training of technicians, training of customs and environment officers)
- Setting up a licensing system to control the import and export of refrigerants
- Training equipment such as leak detectors, gauges, recovery units and cylinders, vacuum pumps, and other related tools for the technicians are provided at training centers.
- Facilitate training of technicians by trained trainers from the government and the private sector. Some training sessions have been conducted, for example, the training of technicians in hydrocarbon technology, training of customs officers, and the training of technicians on carbon dioxide.
- Retrofitting (training of technicians, e.g., Training in hydrocarbon technology)

- Under the Green Cooling Initiative for Africa (GCIA), a survey on alternatives to HFC appliances was done. The findings were presented in a workshop in September 2020 to eventually prepare a strategy for the HFC phase-down management plan in the future.

Action 1. HFC Phase Down

Table 3. 4: Action 1 – HFC phase-down management plan

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
HFC phase-down management plan (HDMP)	Ongoing	National Ozone Unit (NOU) of the Seychelles' Ministry of Agriculture, Climate Change and Environment. Landscape and Waste Management Agency Custom Division	2025 to 2045	Refrigeration and Air-Conditioning (RAC) Landscape and Waste Management	National	2029 Target: 10% reduction in HFCs, relative to baseline levels, 2035 Target: 30% reduction in HFCs relative to baseline levels. 2040 Target: 50% reduction in HFCs relative to baseline levels 2045 Target: 80% reduction in HFCs relative to baseline levels	HFCs
	The objective of the mitigation action						
	The National Ozone Unit (NOU) in Seychelles has a dual objective that emphasizes reducing greenhouse gas (GHG) emissions and reaping health and climate benefits from transitioning away from climate-damaging HFCs to safer and more energy-efficient cooling technologies. By 2035, achieve a 30% reduction. By 2040, sustain the reduction at 50%. The long-term goal is to attain a 100% reduction in HFCs by 2100.						

	Brief description and activities planned under the mitigation action
	The National Ozone Unit (NOU) in Seychelles is mandated to monitor and implement the Montreal Protocol and the Kigali Amendment. The phase-down management plan is designed to significantly reduce HFCs to address harmful pollutants and address the climate target of 1.5 degrees Celsius. The initiative encompasses the following key activities: **Retrofitting of equipment,** Assisting and training technicians to undertake tasks such as leak detection and replacement. **National survey**: Implement a country-wide survey **Strategic Plan Development:** Hiring of a consultant to develop a strategic action plan for HDMP (KIP) **Use of alternative refrigerant:** Train refrigerant technicians on the proper and safe handling of natural refrigerant
	Estimated outcomes and estimated emission reductions
	80% reduction of HFCs by 2045
	Methodologies and Assumptions
	Using CDM methodology (AMS-III.X - EB 44, Repann 17 (Annex 17) Ver01, Energy efficiency and HFC recovery from residential refrigerators), adapted to fit our circumstances, assuming all refrigerants are released to the atmosphere during the time horizon. This category comprises demand-side activities for the replacement of existing, functional domestic refrigerators with more efficient units utilizing refrigerants having no ozone-depleting potential (ODP) and low global warming potential (GWP). Refrigerator de-manufacturing, including recycling of refrigerator materials and recovery of baseline refrigerants (e.g., HFC-134a) is an integral part of the project activity. The baseline scenario is the continued use of existing inefficient refrigerators. If the baseline refrigerators were to stop functioning, the predominant standard practice must be that they are either repaired, but not to manufacturer standards, or replaced with units having

	comparable inefficient electricity consumption characteristics. Emission reduction from the refrigerant components is based on: • The amount of used /recovered HFCs associated with the baseline refrigerators. We assume leakage is considered negligible under this methodology and hence not considered.

3.8 Methodology and Analysis

The industry sector will likely continue using a significant amount of energy as the projected population and GDP increase (e.g., Figure 3-6 below). The CDM methodology to calculate emissions from HFCs was used.

*BEHFC,y =QHFC,y *GWPHFC*

Where:

$BE_{HFC,y}$ =	Baseline HFC emissions in year *y* (t CO_2 equivalent)
$Q_{HFC,y}$ =	Quantity of HFCs consumed/reclaimed in year *y*
GWP_{HFC} =	Global Warming Potential of HFC

Emission reduction from the refrigerant components is based on:

The amount of reclaimed HFC associated with the baseline appliances. The algorithms for this calculation are provided under the baseline equation above. It is assumed that all the refrigerant charge in the project refrigerators is released into the atmosphere during the crediting period.

Figure 3-6 illustrates the BAU scenario with an increasing trend and the mitigated scenario with the targeted reduction during the phase-down period.

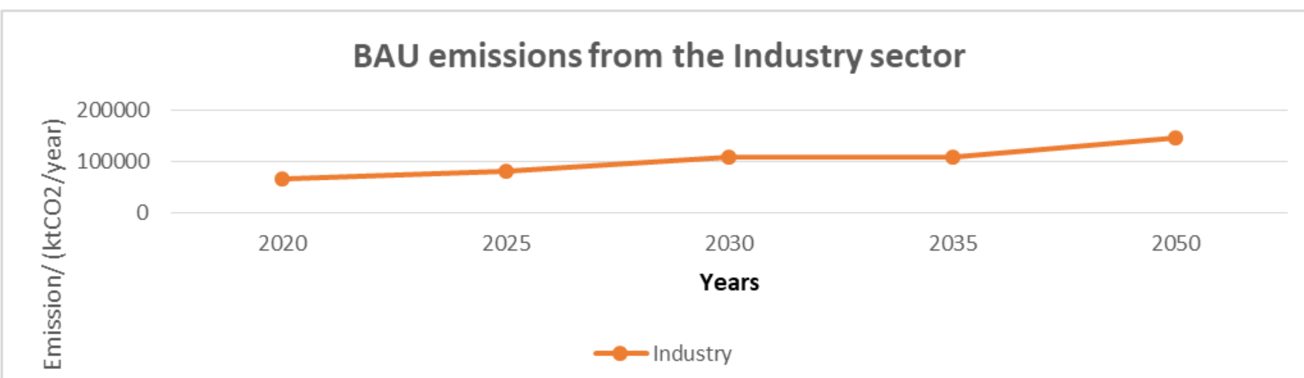


Figure 3. 6: Emission trend under the BAU scenario for the industry sector

Refrigeration and air conditioning is a significant component of the industry sector and contribute significantly to the non-energy emission of Seychelles.

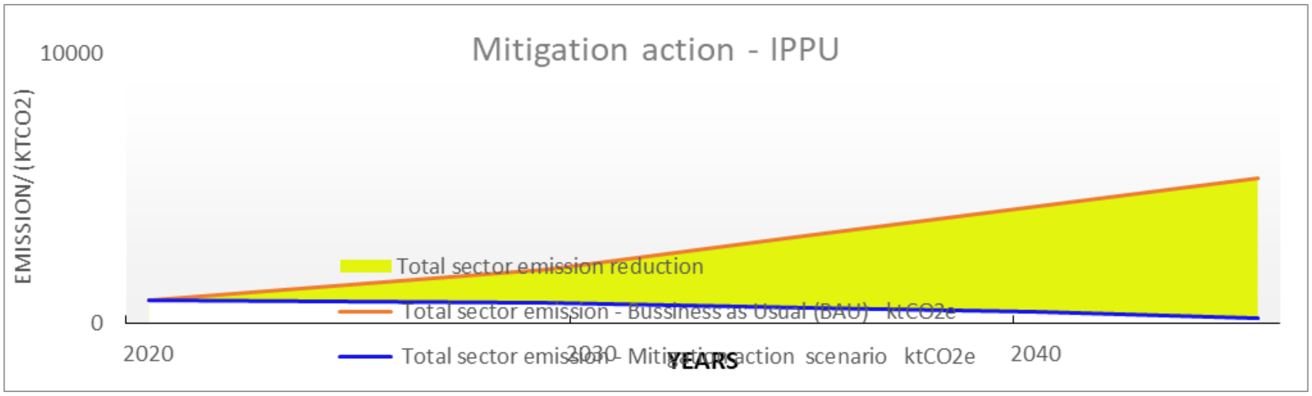


Figure 3. 7: HFC Emission trend under the BAU scenario and the Mitigation scenario

With an 80% decrease in HFC by 2045 (Figure 3-7), Seychelles is likely to reduce 5173 ktCO2eq from the industry sector and, as a cross-sectoral aspect, introduction of more efficient technology will also reduce the amount of electricity use, hence further reduction of CO2.

3.9 Improvement, Data/information gaps

While the work carried out by NOU has been remarkable, there is still a need to have an inventory of existing actions, retrofitting done by the private sector, and the shift from HFC to natural refrigerants. This will allow for better coordination, with stakeholders' engagement and project development incorporating energy efficiency and technology transfer.

A reporting mechanism must allow RAC technicians to report on work undertaken to move from HFC to natural refrigerants.

3.10 Mitigation actions in the AFOLU sector

3.10.1 National circumstances

Over the years, the agricultural sector has played a pivotal economic role and served as a driver in the development of Seychelles (Ministry of Fisheries and Agriculture, 2015). However, the contribution of agricultural production to Gross Domestic Product (GDP) has been declining steadily from around 70% in the late 70s to only 2% in 2020 (The World Bank, 2020). This is attributed mainly to the diversification of the country's economy from an agrarian economy to a manufacturing and services-based economic system in which fisheries and tourism make the majority share of the GDP contribution.

Changes in the country's economic portfolio have led to changes in the country's overall development strategy, forcing the agricultural sector to assume a much lesser role in GDP contribution. The decline in the national agricultural sector was further aggravated by the strategy 2012 – 2017 (GOS, 2012). This resulted in a significant drop in local agricultural production, especially the livestock sub-sector being the most affected, with a decline of 90% vis-a-vis imported meat and meat products. Since there is a strong relationship between livestock and crop production regarding manure production and use, more farms have become reliant on inorganic fertilizers for production. Given the national circumstance as a result of policy change, Seychelles is today in a state of nearly total dependency on importation to support food demand for both the local population and tourists. According to the Department of Trade within the Ministry of Finance, national reliance on food imports is approaching 90%. This is a highly vulnerable state of affairs for the country, thus exposing it to severe impacts and economic shocks should there be any issues in the global food system.

3.10.2 Livestock

As of 2010, the Seychelles' livestock sub-sector was producing 100% of boiler meat and 100% of table eggs, along with 100% of pork consumed locally, while 75% of fruit and vegetables consumed were farmed locally. With the liberalization of food import beyond 2010, an influx of imported meat and meat products is believed to have crippled the agricultural sector (Ministry of Fisheries and Agriculture, 2015). Since 2010, there has not been any coordinated effort to revive the sector. Currently, the sector is at its most vulnerable state with a lack of policy and strategy to guide it. Hence, farmers are being left to run their businesses independently, with minimal support from the government. In recent months, the elimination of subsidies in the livestock sub-sector has added to the issues in that sub-sector. This further contributes to the existing challenges of high production costs, restricted access to land, deterioration in the major livestock bloodlines, lack of an organized market structure, and difficulties in complying with environmental regulations. This gloomy state of the sector is why the growth appears to be constantly slow, as observed in the National Inventory Report of the TNC for the years 2000 to 2018.

3.10.3 Forestry Sector

Being a Small Island Developing State with limited land resources, Seychelles is particularly vulnerable to the impact of climate change (Etongo et al., 2022). Sustainable Forest Management (SFM) can help reduce the risk of damage and possible losses from changing climatic conditions and also help undertake practical mitigation actions. The forests not only have the potential to reduce the country's GHG emissions but also contribute to environmental rehabilitation, create job opportunities, improve the supply of forest produce, increase food security, develop ecotourism, and improve recreation and national well-being (Senterre et al., 2013).

A forestry policy is being prepared to provide for the protection, conservation, and sustainable management of forests, reserves, and related areas in the Seychelles for present and future generations.

Despite the state's effort to develop national regulations and policies to manage forests, the biggest issue with managing forests in Seychelles is a lack of information about the existing forest resources. There is an urgent necessity for the country to conduct a comprehensive forest inventory, which should include the development of allometric equations, biomass assessment, carbon stock assessment, and all associated measures as per the UNFCCC field manual for reforestation and afforestation (UNFCCC, 2015). The national inventory is also crucial in migrating to the Biannual Transparency Report (BTR), which recommends using a higher tier instead of tier 1.

3.11. Mitigation action under the AFOLU Sector

Reforestation and afforestation activities and interventions are vital for mitigation actions in the AFOLU sector. Afforestation and reforestation both refer to the establishment of trees on non-treed land. Reforestation refers to the establishment of forest on land with recent tree cover, whereas afforestation refers to land without forest for much longer. A variety of definitions differentiate between these two processes. Some definitions of afforestation are based on phrases such as "has not supported forest in historical time," others refer to a specific period of years, and some refer to other processes, such as "under current climate conditions." The IPCC Guidelines define afforestation as the "planting of new forests on lands which, historically, have not contained forests (Watson et al., 2000)."

Mitigation actions are being taken, and other climate projects are being implemented; however, despite the primary objective being the reduction of greenhouse gas emissions, it is often the case that no data related to CO_2 removal are recorded.

1. Enhancing crop nutrition and soil and water management and technology transfer in irrigated systems for increased food production and income generation
2. Development and implementation of climate-smart agriculture, including bio and organic package, hydroponics, and agri-waste recycling and composting to reduce the emission of CO_2 from the agricultural sector.
3. Improving the resilience of small farmers to climate change, particularly heavy rainfall, through applying greenhouse and rainwater harvesting technology that can be employed during the dry season.
4. Piloting the agro-forestry sector to optimize forest land for agricultural purposes under organic and natural techniques (a component of the Reef to Ridge project). With a targeted 50 ha of land and planting of 20,000 plants.

5. Rehabilitation of 80 ha on Praslin Island through the effort of TRASS (Terrestrial Restoration Action Society of Seychelles). The aim is to restore the area impacted by forest fires. This will be a combination of reforestation and afforestation.
6. Exploring innovative opportunities for promoting synergies between settlement development and forest restoration to encourage private home-owners to engage in carbon sequestration activity that can significantly reverse the emission trend.

Action 1. Agroforestry, reforestation, and creation and maintenance of forests, nature walks, parks and garden

While the ongoing action (Table 3-5) can significantly impact the reduction of CO2 emissions and potentially gear Seychelles toward its net zero target by 2030, it was not easy to establish the exact impact. This is because, during their conception, these projects did not consider CO2 sequestration. For example, agroforestry is being carried out primarily to mitigate against erosion and minimize the deterioration of soil and water quality, thus minimizing the deposition of agrochemicals from farms into downstream ecosystems. The reforestation and afforestation of Praslin Island through TRASS are primarily being carried out to reduce land degradation caused by forest fire, thus reducing the rate of erosion (TRASS, 2018). As for the establishment of gardens, parks, and forest maintenance, this is undertaken with the primary objective of conserving native and endemic species and maintaining forest canopy. Despite having a considerable potential to reduce national CO_2 emission, the country is unable to account for the CO2 sequestration potential of the action. This is due to a lack of forest inventory data such as tree height, tree biomass, tree diameter, and allometric equations based on tree species found in the Seychelles. At this stage, under the BUR, it was impossible to report on the actual CO2 mitigation effect of the various activities. However, as Seychelles moves to the new reporting system, a comprehensive forest inventory will be vital to establish the national circumstance about the CO2 sequestration potential of local forests, which represent more than 70% of the national land cover.

Table 3. 5: Action 1 – Ongoing reforestation, afforestation, and deforestation avoidance activities through NGOs and Government entities

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Agroforestry, reforestation, and creation and maintenance of forests, nature walks, parks and garden, etc	Under implementation	Ridge to Reef/TRASS/Forestry Service/ Park and Garden Authority, Ministry of Agriculture, Climate Change and Environment, Municipalities, NGOs	2020- 2025	Forestry	National	20,000 plants on 50 ha under the ridge to reef project 100,000 plants under the parks and garden, both projects to produce results by 2025 20 ha to be reforested until the end of 2024. A total of 80 ha has undergone reforestation out of 1500 ha of degraded forest land on Praslin.	CO_2
	The objective of the mitigation action						
	• Increase carbon sequestration; • Improve the environment, forest services, and ecological benefits; • Improve local microclimate; • Improve soil, water quality, and air quality; and mitigate the impact of natural calamities such as floods.						
	Brief description of activities under the mitigation action						
	• Plant production in government and private nurseries • Site selection for tree planting • Site selection for the creation of new gardens/parks. • Tree planting program throughout the island on both agricultural land, public gardens, and open spaces • Restoration and maintenance of forests						
	Estimated outcomes and estimated emission reductions						
	• Planting of at least 100,000 trees annually (until 2025) • Restoration and maintenance of nature walks and forests. • Piloting agro-forestry on 50 hectares of agricultural land.						

Action 2: Innovative proposal - residential reforestation and afforestation activities to offset CO2 emission from land conversion (Forest land to Settlement)

The innovative approach involving the homeowner in CO2 sequestration activity to offset CO2 emission from settlement is based on the fact that most of the emission from the AFOLU sector is from the conversion of land from forestland to settlement. Therefore, it is paramount that actions are taken to address this challenge within the sector. This approach is based on the following assumptions:

1. Minimum land allocation for housing (Residential Settlement) development is 400 m2
2. 65% of the 400 m2 must be left as green space on the property (or 260 m2)
3. 25% of the 260 m2 is considered for reforestation or afforestation activity using woodland trees (or 65 m2)
4. As per the National Bureau of Statistics, Seychelles has 27,155 households, and this project will consider 75% or 20,366 households from 2010 to 2050 (40 years).
5. Five trees should be planted per property
6. Estimate the CO2 sequestration of each tree over the 40-year period using the existing methodology for CO2 sequestration.

3.12 CO_2 estimation methodology

This methodology is based on the UNFCCC Field Manual (UNFCCC, 2015), and the step-wise determination of CO2 removal was adopted from the University of New Mexico (University of New Mexico, 2015). The institution has used the method to determine CO2 removal by terrestrial plants in forest ecosystems, and it follows the principle established in the UNFCCC Field Manual. The database used to acquire the tree parameters was the World Agroforestry Database" (ICRAF, 2019).

The process includes the following steps:

1. Determine the total (green) weight of the tree.
2. Determine the dry weight of the tree.
3. Determine the weight of carbon in the tree.

4. Determine the weight of carbon dioxide sequestered in the tree

5. Determine the weight of CO2 sequestered in the tree per year

Table 3. 6: Action 2: Innovative proposal - residential reforestation and afforestation activities to offset CO2 emission from land conversion (Forest land to Settlement)

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Residential Reforestation and Afforestation	New concept	Forestry Department/ Parks and Garden Authority, Ministry of Agriculture, Climate Change and Environment, Municipalities, NGOs	2010 - 2050	Forestry and Residential	National	Planting of woodland trees (until 2050)	CO_2
	The objective of the mitigation action						
	• Increase carbon sequestration; • Improve the environment, forest services, carbon offset from settlement, and ecological benefits; • Improve household income from wood harvesting. • Mitigate the impact of natural calamities such as floods in residential areas.						
	Brief description of activities under the mitigation action						
	• Plant production in commercial and public nurseries • Signing of agreement between private homeowner and government on planting and maintenance of woodland trees and harvesting of wood • Site selection for tree planting • Site selection for the creation of new gardens/parks. • Tree planting program throughout the island • Restoration and maintenance of forests						
	Estimated outcomes and estimated emission reductions						
	• Planting of at least 100 000 trees annually (until 2024) • Restoration and maintenance of nature walks and forests. • Piloting agro-forestry						

3.13 Land use change under the BAU scenario

Based on the current emission level, continuing with business-as-usual would likely lead to an increase in the conversion of forest to settlement with a decline in the area under forestland from 39,122.04 ha to 32,881.1 ha, being equivalent to 6,240.9 ha of lost in forest land by 2050, with an increase in settlement area equivalent to 5578.71 ha by 2050 (Figure 3-8).

Therefore, using Jackfruit (*Artocarpus heterophyllus*) as a potential woodland as well as a fruit-bearing tree, it is assumed that a 10-year-old *Artocarpus heterophyllus* grows to about 15 meters tall with a trunk about 20 cm in diameter. Based on the above assumptions, this tree will remove about 16 to 20 kg of CO2 per year from the atmosphere and store it as tree biomass for growth and development.

If five trees of *Artocarpus heterophyllus* or similar species were planted per household, this would result in an estimated 80 to 100 kg of CO2 being removed per household per year. Considering the number of households in Seychelles (27,155 households according to NBS), assuming that 75% of houses were to engage in this effort, this will result in 8.1 to 10.1 kt CO2 removed per year.

For the proposal in Table 2, the estimated growth rates and sizes of agro-forestry trees were taken from the World Agroforestry Centre's "Agroforestry Database" (ICRAF, 2019).

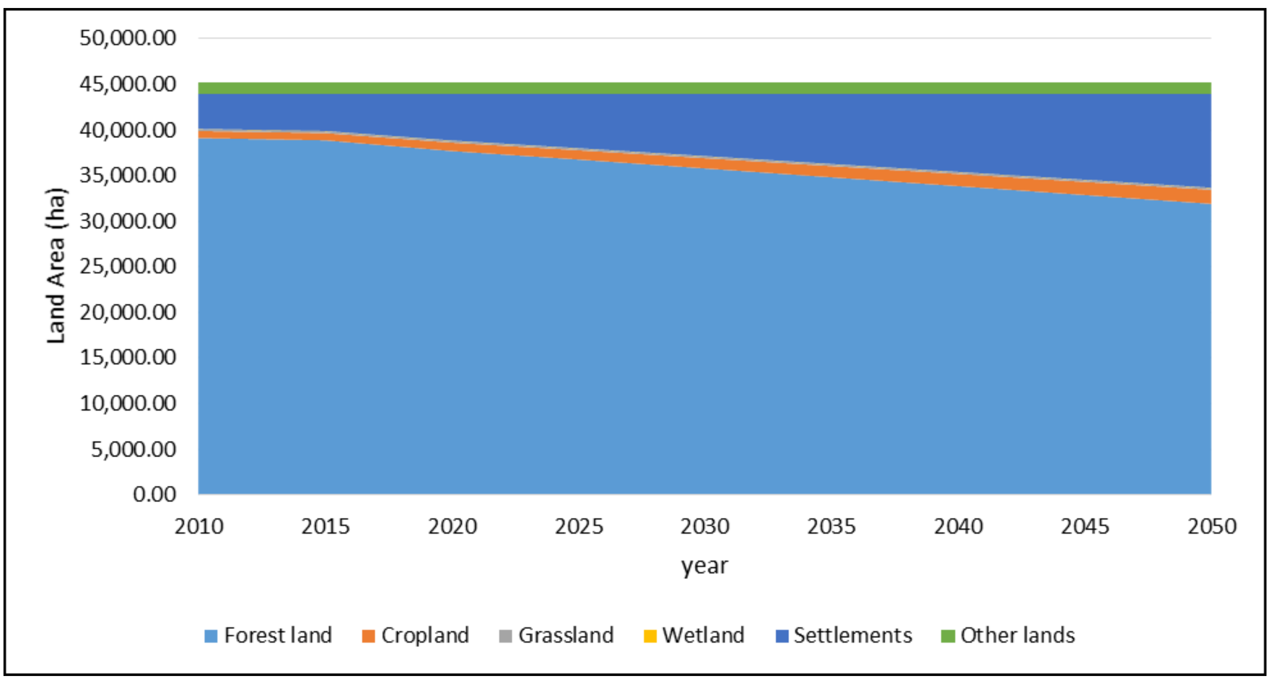


Figure 3. 8: Change in land use under BAU scenario

3.13.1 Emission trend under the BAU scenario

This conversion from forestland will increase the emission of CO2, as indicated in Figure 2. The projection below suggests that by the end of 2028, under the business-as-usual scenario, CO2 emission from settlement will exceed the CO2 sequestration potential of the forest land. The projection indicates that by 2050, Seychelles could reach a net emission of 591 kt CO2 due to an increase in settlement (Figure 3-9). This will indeed have a significant impact on the country's net zero target. However, it must be understood that this projection is based on two data points created using two cover maps generated from low-resolution satellite images. It is said that this scenario can improve with higher resolution and more data points. However, while the situation on the ground is considered, it is clear that the rate of settlement development in the Seychelles will not deviate from the trend indicated despite the possibility of a lower emission level compared to the projected level.

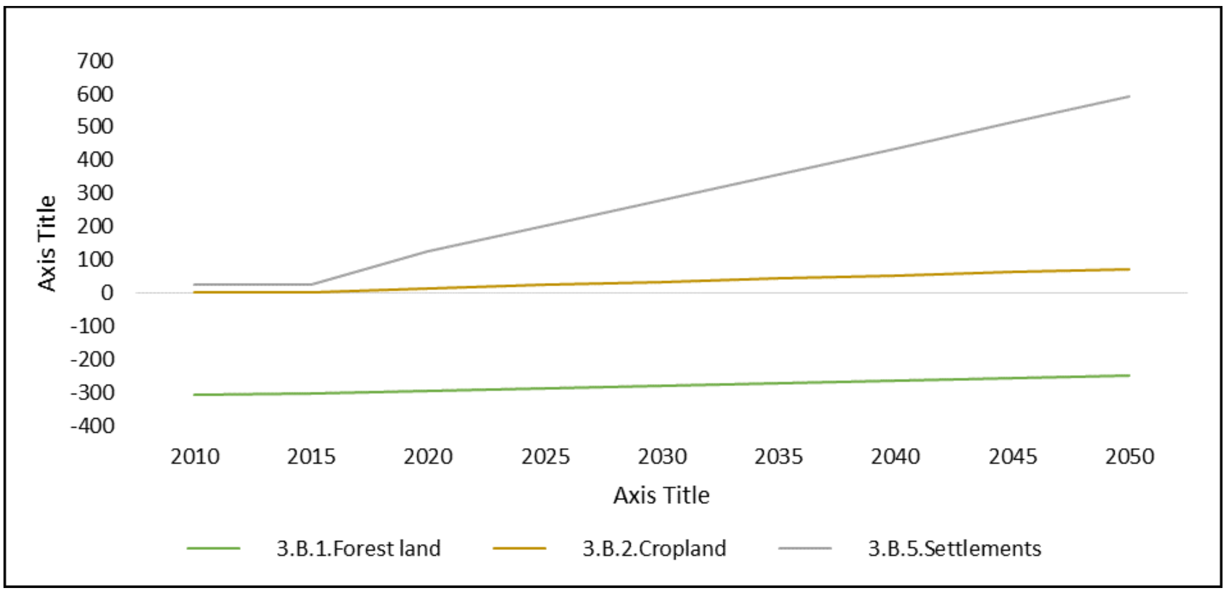


Figure 3. 9: Emission trend under the BAU scenario

3.13.2 Emission trend under the mitigation scenario

Based on the above BAU scenario (Figure 2), there is a need for a sustainable, well-coordinated national effort to mitigate current national emissions to alter the course of national circumstances. The proposal stated above in Table 2 can significantly affect the country's CO_2 emission. The proposed graph below indicates that if this mitigation scenario is implemented, it will likely reduce the CO_2 net emission from settlement by 43.7% or 258.36 ktCO2 in 2050 from the projected 591.6 kt CO_2 net emission (Figure 3-10). However, the overall cumulative average of CO_2 reduction under the proposed mitigation scenario for the 40 years indicates a 51.3%

decrease in net CO2 emission. This mitigation scenario will have a substantial net CO2 removal capacity if adopted. With further refinement of the data through a comprehensive forest inventory and more data points with high resolution for LULUCF, the overall emission will likely change despite the possibility of the trend remaining increasing trend based on current national circumstances.

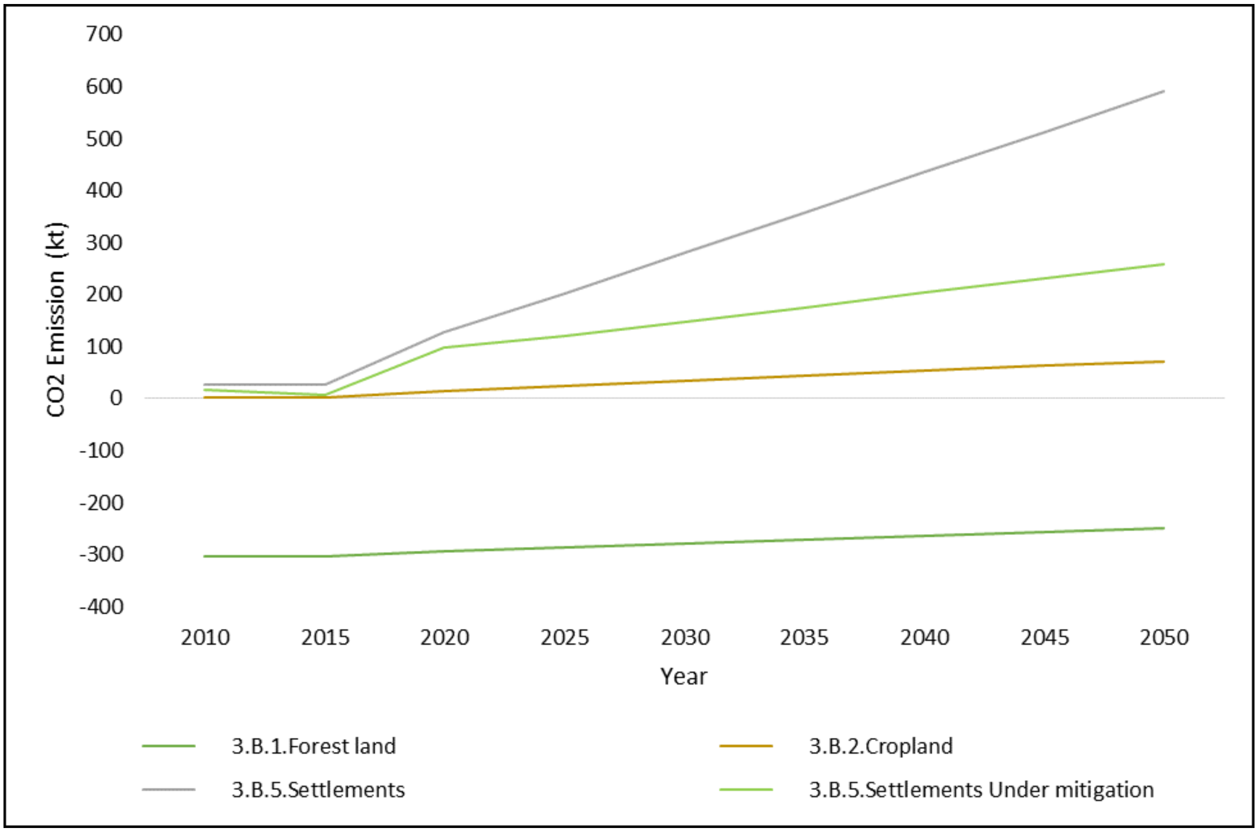


Figure 3. 10: Emission trend under the mitigation scenario

3.13.3 Proposal for improvement

This mitigation report under the BUR for the AFOLU sector encounters challenges similar to those experienced in the development of the NIR under the TNC for the AFOLU Sector. Similar challenges emanate from the fact that the lack of data makes it impossible to capture the complete scenario as accurately as possible. Despite illustrating what is expected to be the correct trend in land use change and emission level, it remains impossible to account for the CO_2 removal capacity of the >70% forest land estimated under the TNC-NIR. With this crucial missing data due to the unavailable forest inventory data, it is, therefore, impossible to have a more accurate estimate of CO_2 removal than projected in this report.

In moving forward, Seychelles must invest in a country-wide forest inventory through the relevant government department, as indicated above at 4.4. The inventory must include:

a. Important timber species, both native and none native

b. Important dual or multi-purpose species, especially those bearing fruit while having potential for timber purposes

Data recorded during inventories must include, for example, timber volumes, growth rates, size distribution pattern, species composition, stand conditions, and location of stands, which are essential for sound forest management and meaningful data to determine the CO2 removal of the forest. Several guidelines and manuals can help to facilitate the inventory process. A few examples are the UNFCCC 2015; Pearson, 2007; Sato et al., 2013.

3.14 Mitigation actions in the waste sector

3.14.1 Introduction

The diversion of organic waste from landfills represents a pivotal step in the Seychelles' commitment to sustainable waste management and reducing greenhouse gas (GHG) emissions. This initiative, as outlined in the Solid Waste Master Plan (2020 - 2035), primarily addresses the pressing challenges of land scarcity and the need for sustainable waste management practices. In addition, this initiative will significantly reduce methane (CH_4) emissions from landfills.

These mitigation actions are designed to progressively reduce CH_4 emissions from landfills, aiming to achieve 80% emission reduction by 2050.

3.14.2 Policies, strategies, and legislations

Seychelles has established policies, strategies, and legislation to guide the nation's waste management and greenhouse gas (GHG) reduction efforts. Collectively, these instruments provide a structured approach to addressing the complex challenges associated with waste disposal and mitigating their environmental impacts.

Key among these documents is the Seychelles Solid Waste Master Plan 2020-2035. This comprehensive roadmap serves as the cornerstone of Seychelles' waste management strategy. The plan delineates a series of objectives and actions, including the Waste Diversion from Landfill initiative, aimed at steering Seychelles towards more sustainable and environmentally responsible waste management practices.

The Environment Protection (Waste Services) Regulation (2021) establishes a regulatory framework for waste management services in Seychelles. This framework mandates that individuals or entities engaged in commercial waste services must obtain a registration certificate and license, ensuring that waste management activities meet established standards and guidelines. The regulation also classifies waste into different categories, specifying how each type of waste should be collected, treated, and disposed of. These classifications facilitate effective waste management practices and promote waste segregation. Additionally, the regulation introduces differential fees based on waste categories, encouraging waste segregation by incentivizing proper disposal practices.

3.14.3 Trend Analysis and Projection

Waste generation in Seychelles has exhibited a notable upward trajectory, primarily attributed to population expansion, heightened importation of goods, and the thriving tourism industry. Interestingly, the average annual population growth rate from 2010-2020 stood at 2.14%.

Analysis of the waste generation data also indicates that the waste generation rate per capita is on the increase. The Compound Annual Growth Rate (CAGR) method was used to estimate the annual waste generation rate per capita.

The CAGR formula is defined as follows:

$$CAGR = 100 \times \left(\left(\frac{V_{End}}{V_{Initial}} \right)^{\frac{1}{P}} - 1 \right)$$

Where:

CAGR = Compound Annual Growth Rate

V_{End} *= End Value = 0.975156466*

The CAGR formula calculates the annual growth rate as a percentage, accounting for any fluctuations over the specified time frame. It offers insights into the consistent growth rate, smoothing out yearly variations. Applying the CAGR method, the annual waste generation growth rate was calculated from 2000 to 2019. This calculation excluded the anomaly caused by the COVID-19 pandemic in 2020, ensuring a more accurate representation of the long-term trend.

By transposing the CAGR formula, the estimated waste generation rate was calculated for each year between 2020 and 2050.

$$V_{End} = V_{Initial}\left(\frac{CAGR}{100} + 1\right)^{P}$$

Where:

$V_{Initial}$ = *Initial Value* = 0.525515475

CAGR = Compound Annual Growth Rate = 0.031394

V_{End} = End Value

Subsequently, the derived waste generation rates were multiplied by the corresponding population data for each year to compute the estimated total waste tonnage. Left unaddressed, CH_4 emissions from landfills were on a trajectory for significant growth in the coming decades, driven by population expansion and heightened waste production. However, by adopting targeted mitigation measures, CH_4 emissions from landfills are anticipated to decline significantly. By 2050, these measures are forecast to reduce CH_4 emissions to an 80% below the business-as-usual scenario, amounting to a reduction of 2,328 metric tonnes of CH_4 emissions (Figure 3-11).

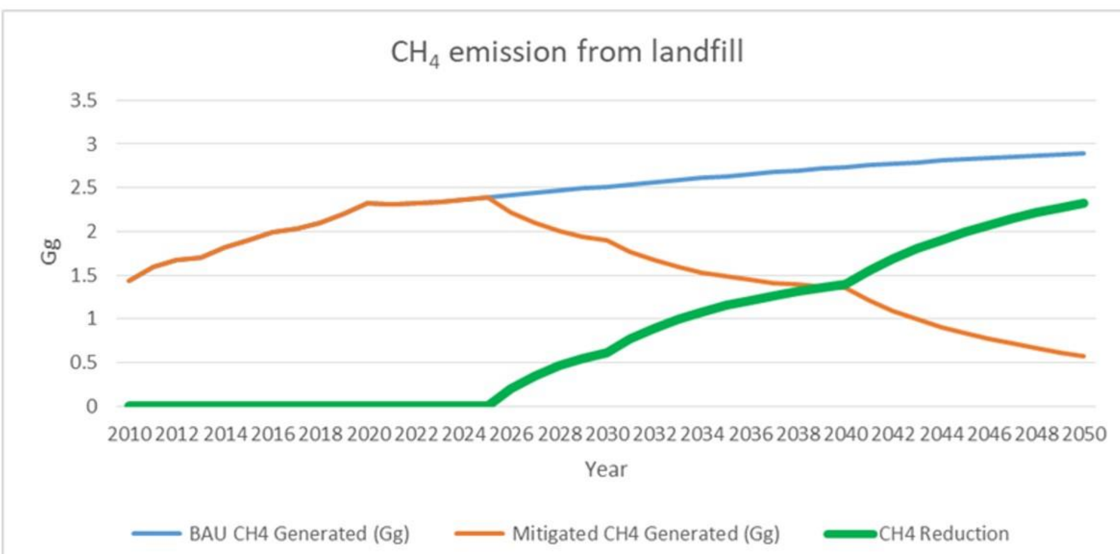


Figure 3. 11:CH4 emission trend 2010 - 2050

3.15 The Sector Action

The Waste Diversion from Landfill initiative in Seychelles, as delineated in the Solid Waste Master Plan (2020 - 2035), serves a dual purpose, emphasizing both the reduction of greenhouse gas (GHG) emissions and the diminishing reliance on landfills. The objectives of this mitigation action encompass the following key milestones:

2025 Target: Garden and Park Waste Diversion

By 2025, the primary aim is to completely divert all green and commercial food waste, constituting approximately 44% of the total organic waste away from landfills. This initial step sets the foundation for substantial emissions reduction.

2030 Target: Commercial Food Waste Diversion

Building on the progress made by 2030, the initiative targets diverting 50% of household food waste and 50% of paper and cardboard waste from landfills. This milestone represents a substantial 66% reduction in organic waste sent to landfills, resulting in a 614 tonnes reduction in CH_4 emission.

2040 Ultimate Goal: 100% Organic Waste Diversion

The overarching, long-term aspiration is to attain 100% diversion of all organic waste from landfill disposal by 2040. This ambitious objective aligns with Seychelles' commitment to sustainable waste management practices and eliminating CH_4 emissions from landfills. It is anticipated that as a result of these actions, by 2050, methane emission from landfills will have reduced to 2,328 tonnes below the business-as-usual level scenario.

Key Activities Under the Mitigation Action:

Differential Fee Structure: Implementation of a differential fee structure for waste disposal strategically designed to incentivize waste segregation at its source.

Commercial Waste Composting: Establishment of commercial composting facilities dedicated to processing organic waste. This initiative diverts not only organic waste from landfills but also yields valuable compost for agricultural applications, fostering circularity and reducing reliance on chemical fertilizers.

Promotion of Household Composting: Launch of comprehensive public awareness campaigns and support for household composting of domestic organic waste. Empowering residents to actively participate in waste reduction efforts and create nutrient-rich compost for personal use.

Introduction of Segregated Waste Collection System: Implementation of a segregated waste collection system, enabling residents and businesses to segregate recyclables, organic waste, and non-recyclables right at the source. This streamlined approach enhances sorting efficiency and facilitates effective diversion.

Seychelles has already enacted regulations pertaining to differential fees, signifying a commitment to promoting waste segregation. Investment in a waste shredder to process organic waste for composting is another proactive measure the country taken. The phased approach outlined for diverting parks and garden waste, followed by commercial food waste, cardboard, paper waste, and finally, domestic food waste, demonstrates a structured and pragmatic strategy.

It is important to note that promoting household composting and establishing a segregated waste collection system involves educating the general population and may pose challenges. However, promotional campaigns are underway, with full-scale success anticipated by 2040.

3.16 Data/Information Gaps

While significant effort has been made to develop the Waste Diversion from Landfill initiative, several critical data and information gaps remain. These gaps are pivotal to enhancing the initiative's effectiveness and making informed decisions. The following areas warrant particular emphasis:

Fossil Fuel Consumption Data: There is a notable absence of data concerning the rate of fossil fuel consumption associated with landfilling organic waste. To address this gap, gathering comprehensive information on the fuel consumption patterns for landfilling and composting organic waste is essential. It has been assumed that fuel consumption for composting is similar to that of landfilling; obtaining accurate data in this regard is imperative for a precise assessment of the initiative's environmental impact and cost-efficiency.

Parks and Garden Waste Data: A significant information void exists concerning parks and garden waste generated by various sectors, including tourism, government, and domestic sources. This information gap hinders the ability to estimate precisely the financial incentives required for waste generators. The same challenge extends to other organic waste sources. Acquiring data on waste disposal costs borne by generators and the financial ramifications of the initiative is crucial for effective planning and budgeting.

Market Demand for Compost: Past attempts at composting organic waste faced setbacks primarily due to lacking a market for the end product. To avoid the occurrence of a similar challenge, it is imperative to gather information on the current demand for compost and ascertain the willingness of the farming community to transition to organic fertilizers.

Furthermore, understanding the overall demand for compost in public green spaces is essential for gauging market feasibility and potential sustainability.

Addressing these data and information gaps is instrumental in refining the Waste Diversion from Landfill initiative, ensuring its environmental and economic viability.

3.16.1 Improvement Plans

As the Seychelles Waste Diversion from Landfill initiative moves forward, it is crucial to maintain a proactive stance and continually enhance its strategies and practices. These improvement plans to outline specific steps and initiatives to optimize the Waste Diversion from Landfill program.

Data Enhancement and Monitoring

The accurate collection and analysis of data are fundamental to the success of the Waste Diversion from Landfill initiative. Improving the quality and scope of data collected is essential for precise decision-making and progress assessment. The improvement plan should include:

- Implementing digital data collection systems for waste generation and diversion rates.
- Collaborating with private and governmental sectors to gather comprehensive data on organic waste and its sources.
- Conducting regular waste audits to assess program effectiveness.
- Investigating methods to determine fuel consumption differences between landfilling and composting.

Fostering Market Demand for Compost

The prior setback in composting stemmed from a lack of market demand for the product. To ensure that compost generated through the initiative finds sustainable uses, the aim is to:

- Identify and engage potential markets for compost within the agricultural and landscaping sectors.
- Foster partnerships with local farmers and growers to encourage the transition to organic fertilizers.

- Assess the broader demand for compost within the community for public green spaces and residential properties.

Promoting Household Food Waste Diversion

The diversion of household food waste is a challenging aspect of the initiative that requires active engagement with the public. Plans for achieving this goal should include:

- Continuing and expanding public awareness campaigns to educate households about the benefits of food waste diversion.
- Offering incentives to encourage the adoption of household composting practices.
- Implementing a segregated waste collection system that facilitates the separation of recyclables, organic waste, and non-recyclables at the source.

Commercial Food Waste Diversion

Diverting commercial food waste from landfills represents a significant milestone. Seychelles should focus on:

- Enforcing waste regulations requiring businesses to divert food waste to designated composting facilities.
- Engaging the commercial sector through training programs and awareness campaigns.
- Collaborating with businesses to ensure efficient and cost-effective waste diversion practices.

Suggestions and Needs for Improvement of Reporting

As Seychelles continues to advance its Waste Diversion from Landfill initiative, several crucial aspects are required to enhance the reporting mechanisms. By addressing these needs, Seychelles can better monitor the progress and impact of the initiative and make data-driven decisions for ongoing improvement. The following suggestions are put forth:

Comprehensive Data Integration

A critical need is integrating data from various sources, including waste generation rates, diversion measures, and environmental outcomes. Implementing a unified reporting system that collates data from households, businesses, waste management facilities, and environmental agencies will provide a more holistic view of the initiative's effectiveness.

Real-Time Data Tracking

To ensure accurate and up-to-date reporting, Seychelles should explore the development of real-time data tracking and reporting tools. Digital platforms and mobile applications can enable waste generators and service providers to report their diversion activities, and the data may be shared in real-time.

Establishment of Performance Indicators

The Seychelles should establish key performance indicators (KPIs) to measure the initiative's success. These indicators should cover reductions in greenhouse gas emissions, waste diversion rates, consumption of composting products, and cost savings for both waste generators and the government.

Transparency and Accessibility

Make waste diversion data accessible to the public, policymakers, researchers, and international organizations. Transparency in reporting fosters accountability and promotes a broader understanding of the initiative's significance.

Market Analysis

The market for compost products in Seychelles should be assessed continuously, considering factors such as demand, pricing, and potential partnerships with local farmers and landscapers. This information will help shape composting strategies and market development efforts.

Table 3. 7: Mitigation Action 1 – Waste Sector

Name of the mitigation action	Status	Implementing institution	Duration	Sector and subsector	Scope	Quantitative targets (both GHG-related and non-GHG impacts)	GHGs covered
Waste Diversion from Landfill	Ongoing	Landscape and Waste Management Agency	2010 to 2050	Waste Solid Waste	National	2025 Target: 44% organic waste diverted from landfills, relative to baseline levels, will result in an initial reduction of 199 tonnes of CH_4 emissions. 2030 Target: Further increase the reduction to 66% diverted from landfills, resulting in an initial reduction of 771 tonnes of CH_4 emissions. 2040 Target: 100% diversion of organic waste away from landfill disposal, resulting in an initial reduction of 1551 tonnes of CH_4 emissions 2050 Target: CH_4 emission 80% below baseline, amounting to a reduction of 2328 tonnes of CH_4	CH_4

						emissions, resulting from previous actions and continued diversion of organic waste from landfill	
	The objective of the mitigation action						
	The Waste Diversion from Landfill initiative in Seychelles, as outlined in the Solid Waste Master Plan (2020 - 2035), serves a dual purpose, emphasizing the reduction of greenhouse gas (GHG) emissions and the reduction of landfill dependence. The objectives of this mitigation action are as follows: • By 2025, the aim is to achieve a complete diversion of garden and park waste and commercial food waste, constituting approximately 44% of the total organic waste away from landfills. • By 2030, target the diversion of 50% of household food waste and 50% of paper and cardboard waste from landfills, resulting in a substantial 66% reduction in organic waste sent to landfills. • The overarching, long-term goal is to achieve a 100% diversion of all organic waste from landfill disposal by 2040. • These measures will effectively eliminate CH_4 emissions from landfills, with the 2050 emission expected to be 80% below the baseline level.						
	Brief description and activities planned under the mitigation action						
	The Waste Diversion from Landfill initiative in Seychelles is designed to significantly reduce CH_4 emissions from landfills while simultaneously addressing land scarcity concerns and promoting sustainable waste management practices. The initiative encompasses the following key activities: Differential Fee Structure: Implement a differential fee structure for waste disposal to encourage waste segregation at the source. Composting of Commercial Waste: Establish commercial composting facilities to process organic waste generated by businesses. This initiative not only diverts organic waste from landfills but also produces valuable compost for agricultural use. Promotion of Household Composting: Launch public awareness campaigns and provide support for household composting of domestic organic waste. This empowers residents to reduce waste sent to landfills and create nutrient-rich compost for their gardens. Introduction of Segregated Waste Collection System: Implement a segregated waste collection system, enabling residents and businesses to separate recyclables, organic waste, and non-recyclables at the source. This facilitates efficient sorting and diversion.						
	Estimated outcomes and estimated emission reductions						
	The outcome of this mitigation action will start manifesting itself in 2026, with an initial 8% reduction in CH_4 emissions, equivalent to 199 tonnes. This reduction trend will continue, reaching a 30% reduction, equivalent to 771 tonnes, by 2031. By 2041, the mitigation action will achieve a 56% reduction, amounting to 1551 tonnes of CH_4 emissions. CH_4 emission will continue to reduce, reaching an 80% reduction below business as usual, amounting to 2328 tonnes reduction in CH_4 emission by 2050.						
	Methodologies and Assumptions						
	Methodology:						

	• To estimate the average increase in waste generation per capita, waste activity data were utilized, spanning from 2010 to 2019, employing the Compound Annual Rate of Growth (CARG) methodology. • Using the derived average increase in waste generation rate per capita, waste generation rates are projected for each year from 2020 to 2050. • Population projections up to 2050 were sourced from Worldometer and multiplied by the projected waste generation rate to estimate the total annual waste generated. • CH_4 emissions for each year were calculated using the IPCC 2006 guidelines for emissions from a managed landfill under a business-as-usual scenario. • Reduction in organic waste sent to landfills was computed based on the baseline ratio of paper/cardboard, textile, food, park, and garden waste. The resulting CH_4 emissions for each year were calculated using the IPCC 2006 guidelines, taking into account the mitigation action. • The reduction in CH_4 emissions was calculated using the AMS-III, F Small-scale methodology: Avoidance of methane emission through composting (Version 12.0). Assumption • The waste generation rate per capita will continue to follow the currently observed trend over the mitigation period. • Any increase in the use of biodegradable alternatives to plastic products will not have a significant impact on the increase of organic waste sent to landfills. • Compost generated as part of the initiative will be efficiently managed and utilized, ensuring that it does not become a new source of CH_4 emissions. • Population projections up to 2050 will align with Worldometer estimates. • The CH_4 emissions calculations will be based on the IPCC 2006 guidelines for emissions from a managed landfill under business-as-usual and mitigation scenarios. • Emissions from the consumption of fossil fuels during the composting process are negligible and have been considered as such in the emissions calculations. • Emissions of nitrous oxide in the composting process are minimal and have been considered negligible in the emissions calculations.

3.17 Challenges and Barriers for the Implementation of Mitigation Measures

There are many barriers to effective mitigation options in Seychelles, many of which are common to developing countries, particularly SIDS, although some are country-specific. The IPCC lists some common barriers, including:

Capital: Access to capital is limited. The capital costs of renewable energy technologies are generally higher than those of conventional technologies. Also, owing to the risks perceived for new technologies, financing costs will tend to be higher.

Trade barriers: Although many countries are revising their trade policies to liberalize markets, substantial tariff barriers remain, in many cases, for imports of (emission-reducing) foreign technologies, including energy supply equipment.

Vested Interests: National interest groups such as powerful extraction and construction companies can influence technology choices in favor of conventional technologies.

Institutional and administrative difficulties: Such difficulties exist in terms of developing technology transfer contracts that can be a necessity to qualify regional construction companies as potential partners of entrepreneurship.

Regional Cooperation: There is a need for greater regional cooperation among developing countries, both in R&D works and in the international commercial contracting network.

Access to information: Developing countries have, in general, poor access to information. It is one thing to recognize that the information and technology desired are available, but it is quite another issue to gain access to them.

Differing needs: The needs of the developing countries are quite different to those of the developed countries. Developing countries are generally still focused on large capacities of cheap, reliable power with low technical risk and have new technologies as a lower priority. In addition, most developing countries rate development as a higher priority than reducing emissions.

Economic incentives: Incentives for donors are weak, mainly when energy demand is scarce and scattered.

These barriers, as highlighted by the IPCC, are explicitly discussed in terms of the specific situation of Seychelles as presented below:

Capital/Finance: The main barrier to mitigation options being realized in Seychelles (as in most developing countries) has been the slow progress of finance transfer from the international funding agencies providing support for mitigation actions. To date, there has been an emphasis on obtaining market finance and on market mechanisms to pay for mitigation options.

The current status of the Paris Agreement (2015) is a testament to the difficulty in assuming that market forces will provide the necessary money flows. Projections for the current global NDCs indicate that some trillions of USD would need to be transferred to developing countries just to keep the temperature below 3.7^{o}C. Unless this transfer eventuates, the action plans developed for mitigation are not likely to be acted upon and will continue to exist in paper format only.

Keeping the temperature increase below 2^{o}C will require an even higher level of transfer and a genuine commitment on the part of the developed nations of the world, along with an actual decrease in developed country emissions' level. Seychelles has been fortunate in recent years in that a good deal of aid and technical expertise has been made available from the multi-lateral, bi-lateral, and other global climate finance sources. However, the available resources are insufficient, and further support will be needed to close the mitigation gap as Seychelles transitions to a low-carbon economy.

Vested interests: These constitute a considerable barrier in several areas. One is in terms of data sharing. In the Seychelles, it has been challenging to extract sectoral and sub-sectoral data from the major stakeholders. Another barrier is in the transport sector, where the vehicle importing companies are interested in increasing the number of cars on the roads. Finally, the vested interest of the private sector in growing the economy is often at odds with severe emissions reduction.

Institutional and administrative difficulties: Such in-country difficulties can be severe obstacles to easy technology transfer. Also included here might be the difficulty in retaining qualified personnel in administrative positions in government due to high staff turnover.

Regional cooperation: This has generally not been a significant problem in the Indian Ocean region as there are some regional organizations (IOC, SADC, COMESA) fostering cooperation, all with good intentions in terms of assisting with climate change mitigation and adaptation.

Access to information: There appear to be difficulties in this domain. However, in terms of sharing information between government departments in Seychelles, improvements can be made.

Differing needs: The differing needs of all developing countries compared to the developed nations present a severe barrier globally to emissions reduction, a barrier that has played out at all of the major UN meetings designed to encourage countries to cooperate on emissions reductions. The issue is one of equity and as to who has been responsible for past emissions. In almost all cases, developing countries insist that climate change must be integrated into development strategies and not subservient to development.

Economic incentives: The problem of attracting aid transfers was covered in the lack of capital barrier, but, in addition, there has been a problem with private sector participation in Seychelles, particularly in terms of the on-grid electricity sector. There are other barriers, including the lack of expertise in-country to facilitate the realization of mitigation options. But these are also largely related to a lack of finance and a brain drain of experienced people from the country to greener pastures in terms of salaries. Government departments, particularly, have great difficulties retaining qualified staff due to relatively low salary levels. Training is obviously needed, but they are less likely to succeed unless such measures are accompanied by mechanisms to keep the trained staff.

3.18 Conclusion

Seychelles is a Small Island Developing State (SIDS) with absolute levels of CO_2 emissions, which is minimal and corresponds to a value below 0.003% of the global emissions. The country is also one of the most vulnerable to the effects of climate change and has much to lose should the worst predictions from increased temperature levels eventuate.

As Seychelles commits to drive efforts and initiatives to enhance its mitigation contribution, achieving this noble objective will require financial, technical, and capacity-building support from donor organizations. With the hindsight of the 2015 Paris Agreement and the present commitments from the countries of the world leading to a projected temperature increase above 3 degrees Celsius, it isn't easy to be optimistic.

Nevertheless, there are options for Seychelles to do its share in terms of mitigation, as discussed earlier. The key barrier, however, is securing the required finance for its technology needs. In addition, it is clear that developing countries need to see some real action from developed countries, both to give incentive to their efforts and to spearhead mitigation measures, such as electric vehicles and solar PV that can then be cost-effectively transferred to developing countries.

CHAPTER 4 DOMESTIC MEASURING, REPORTING AND VERIFICATION (MRV) SYSTEM IN SEYCHELLES

4.1 Government structure relevant to MRV

To integrate the MRV system into the organizational structure of the Seychelles Government (GoS), an institutional arrangement has to be developed. Such an organizational structure will ensure precise assignment of roles and responsibilities, adequate capacity and human resources, and a smooth connection and regular exchange of information between the administrations/institutions and key stakeholders involved in MRV activities.

In this context, a sustained institutional arrangement for the Biennial Update Reports is proposed to create an appropriate working framework. This working framework should cover the management and coordination of the parties involved in the MRV system. In addition, sectoral experts should be part of the working framework to provide technical knowledge and data.

The Climate Change Department and National Climate Change Committee will coordinate the preparation of greenhouse gas inventories to monitor and control emissions in various key sectors.

4.2 MRV Institutional Arrangements

The institutional arrangement set up under the Third National Communication consisting of six Technical Working Groups was adopted to prepare the First Biennial Update Report (fBUR). The sectors for which Technical Working Groups were set up are as follows: Energy Industries, Transport, Energy Other Sectors, Industrial Processes and Product Use, Agriculture, Forestry and Other Land Use (AFOLU), and Waste (Solid and Liquid). These sectors are as per the IPCC categories for reporting emissions and removals.

For the preparation of National Communications, including the BURs, the Ministry of Agriculture, Climate Change and Environment (MACCE) set up a National Communication (NATCOM) Project Management Team that comprises a Programme Manager, finance officers, and an administrative assistant who assists the National Project Director in the compilation of the communications. The current structure has led to coordination challenges, as well as limited institutional memory (as it is rarely the same staff members who work on successive National Communications), a lack of systematic data archiving, and a heavy reliance upon short-term consultants. For the continuous preparation of National Communications, GoS has taken steps and made efforts towards creating a sustainable institutional structure.

Preparation of the BUR requires a comprehensive study of technical as well as administrative arrangements and key stakeholders' participation in various tasks and activities. To ensure adequate attention and participation from relevant stakeholders, elaborate implementation arrangements need to be created. The National Climate Change Committee (NCCC), under the chairmanship of the Principal Secretary for the Department of Climate Change and the UNFCCC National Focal Point within the MACCE, oversees the preparation and implementation of the BUR work program. Various line ministries and government departments, most concerned with various information elements in this report, have representation on the National Steering Committee of the NCCC. The figure below (Figure 4-1) presents the implementation arrangement of Seychelles FBUR.

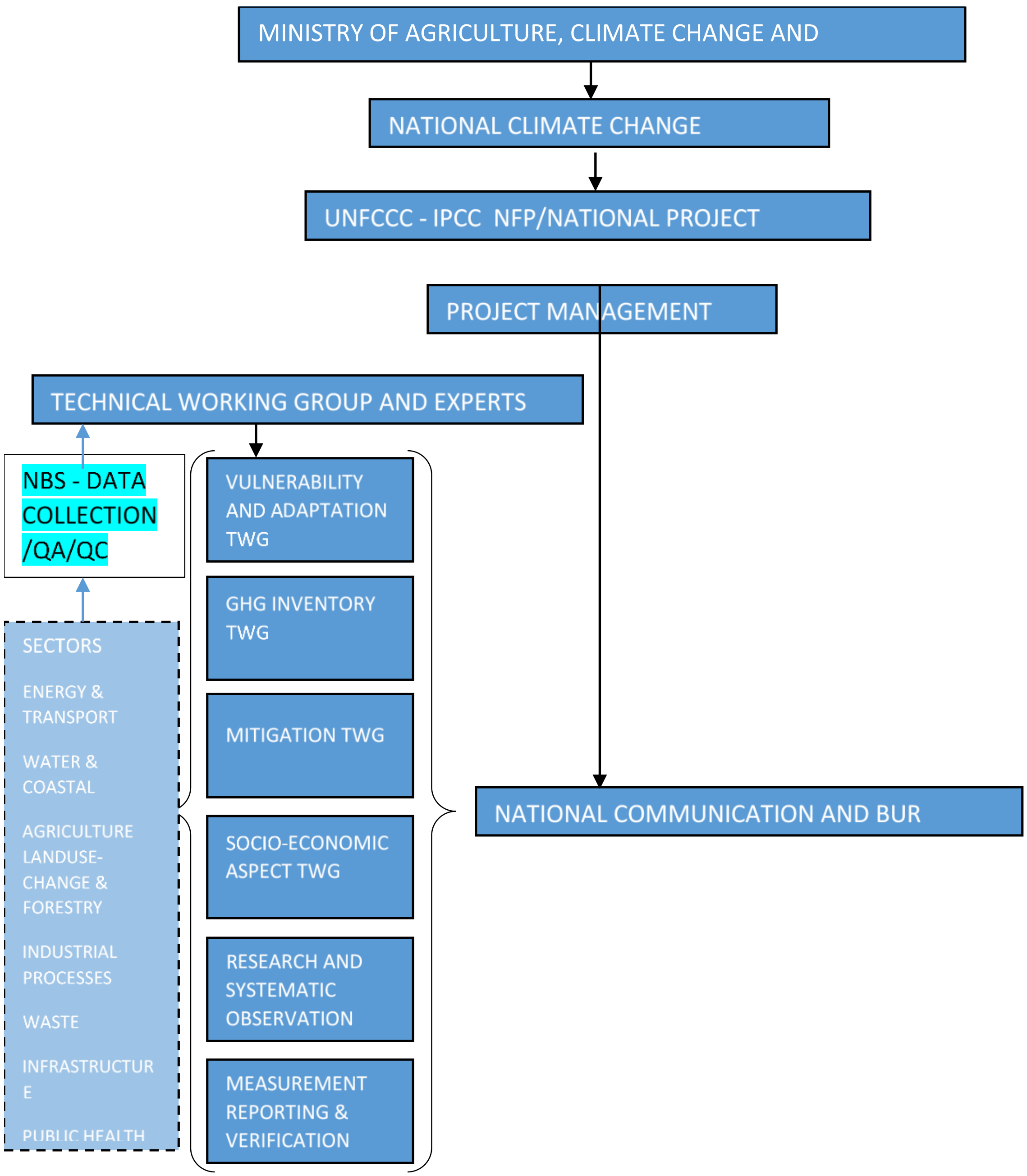


Figure 4. 1: Proposed Implementation Arrangement for the first BUR

Technical consultations on multiple and multidisciplinary aspects of information relating to GHG inventory and mitigation actions were held during the process. Considering the range of requirements, it is practical to have Technical Working Groups (TWG) to provide technical guidance to prepare BUR. These working groups have members from various organizations, including the government, academia, and civil society organizations.

To implement the programs and sustain them, the implementation arrangement, as in Figure 4-1 was proposed. The proposed structure covers all areas of the current setup and the setting up of the MRV system to allow for greater transparency and to cater to all possible policy and Nationally Appropriate Mitigation Actions (NAMA) likely to be developed in the future as an integrated system for the Seychelles.

For the data request, it is necessary to sign a Memorandum of Understanding and Confidentiality Agreement (CA) with the data provider. A template for the CA and MoU is reported in the United States of America's Environment Protection Agency (US EPA) templates.

Before and during the input of the data collected in the Inventory software, it is necessary to gather and report as much information as possible on the data collected, such as the contact details of the data provider, methodology used, data processing methodologies (if applicable), calculations, assumptions (if any), recalculations (if any), etc. All this information should be collected as described in the US EPA templates.

It is also crucial at this stage to consider the quality Assurance/Quality Control (QA/QC) procedures during the data collection. To that end, the QA/QC procedure proposal is reported in US EPA templates.

4.3 Proposed archiving system

Data archiving is one of the most essential procedures to be considered in the Inventory System. An Archiving System helps make a national inventory transparent and reproducible and facilitates the development of subsequent inventories by future inventory staff and category leads. Some preliminary work will be initiated under the Capacity Building Initiative project.

All information used to create the inventory should be archived in a single location in both electronic and/or hard copy (paper) format so that future inventory managers can reference all relevant files to respond to reviewer feedback, including questions about methodologies.

The main features of the archiving system are:

- Information should be archived/stored in a single location: The Department of Climate Change and Energy (DCCE) seems to be the more appropriate location. Other options could be the cloud or the IT department.
- Both electronic and paper storage formats should be considered.
- Include all emission factors, activity data, and documentation of how these factors and data have been generated and used.
- Document all QA/QC procedures, reviews, key categories, and planned inventory improvements (e.g., use QA/QC template).
- Archive multiple copies, including frequent backups.

Contents of documents to be archived:

- Lists and Copies of References
- Expert Judgment (Documentation, Contact Information)
- Key Category Analysis
- Uncertainty Analysis
- QA/QC Measures
- Changes and Recalculations
- Improvement Plan
- Archiving Plan
- Review Findings and Responses
- Templates for Future Work
- Results, Analyses, Plans, Measures

As Seychelles moves towards more frequent reporting in the form of BTRs and the upcoming Fourth National Communication (FNC), there is a greater need for institutional continuity and systematic procedures, including deeper engagement with civil society and the private sector. There is a pressing need to build internal capacities for data collection and GHG estimation to improve data supply and quality.

A Measuring, Reporting, and Verification (MRV) system is required for GHG mitigation/sequestration actions to support NAMAs and the regular submission of BTRs.

There is no completed formal recording system for tracking mitigation actions within the Seychelles' institutions, which would be used to conveniently report on the status and the progress of activities implemented. Nevertheless, Seychelles is developing a framework that will cater to MRV approaches for individual mitigation actions. Two vital considerations for developing this framework include:

a) A uniform process;

b) A common sectoral assumption to provide comparability with existing projections.

The framework should be aligned with data and emission factors in the national GHG inventory where feasible to avoid double counting. All activities should be reported using standardized reports of the IPCC (2006 Guidelines) on implementation and impacts. The reported data will provide quality information for political decision-making and reporting on the implementation of mitigation action at the national level and input for the next Biennial Update Reports/Biennial Transparency Reports (BUR/BTR) compilation.

Seychelles continues to build and improve its system for measuring, reporting, and verifying mitigation actions and their effects while tracking support received in implementing these. The Mitigation Working Groups (MWG), with representatives responsible for collecting and reporting data, should have well-developed procedures, and these arrangements must be reviewed and upgraded to be fully operational and to deliver for meeting reporting standards.

To make the appropriate linkages on funding, the Ministry of Finance and Economic Planning may be a full-fledged member of the MRV mitigation and support systems. Ministries/Institutions/Agencies implementing mitigation actions will automatically join the mitigation working group to provide data that they have collected.

4.4 Prioritized Actions for MRV System in Seychelles

This section includes the prioritized actions to develop the MRV system further. Based on the MRV system's current situation, some activities/tasks require attention and improvements. Depending on the activity/task, the necessary resources (in terms of time, staff, or capacity) to eventually achieve complete implementation will vary. Implementing the MRV system is an iterative process: it will evolve in different steps. It will need to adapt to the changes, for example, institutions or reporting needs.

Key activities/tasks	**Status**
Key activity 1: Review current MRV activities	Implemented
Key activity 2: Establish institutional arrangements	On Going
-Establish a National Legal or Formal Arrangements	On Going
-Choosing an appropriate Coordinating Body	Implemented
-Engage Stakeholders	On Going

-Build In-Country Institutional and Technical Capacity	On Going
-Maintain a Motivated and Stable Coordinating Body	Implemented
-Report on Institutional Arrangements within BURs	Implemented
Key activity 3: Assess data gaps and needs	On Going
-Assess and prioritize data gaps	Not Implemented
-Identify how existing MRV systems can be extended to address data gaps	Implemented
Key activity 4: Establish data management processes	
-Develop systems to improve data quality	On Going
-Develop data management systems	Not Implemented
-Address data gaps	On Going
-Develop data improvement plans	Not Implemented
Key activity 5: Build MRV capacity	Not Implemented
Key activity 6: Improve the MRV system over time	Not Implemented
-Ensure MRV reports are relevant	Not Implemented
-Consider options for continuous improvement	Not Implemented

CHAPTER 5 CONSTRAINTS AND GAPS AND RELATED FINANCIAL, TECHNICAL AND CAPACITY NEEDS AND SUPPORT RECEIVED

5.1 Introduction

For Seychelles to meet its obligations made to the Conference of Parties (COP) regarding its reporting requirements under the United Nations Framework Convention on Climate Change (UNFCCC) concerning the National Communications (NC) and the Biennial Update Report (BUR), it needs further and continuous support in i) consolidating the existing technical capacity level it has reached, ii) consolidating and improving the institutional framework in place, iii) integrating Climate Change in all aspects of socio-economic development.

With the full implementation of the Paris Agreement (PA) in 2020 and the enhanced transparency framework that Non-Annex 1 countries need to adhere to, Seychelles has to reassess its needs continuously to ensure it aligns with local realities and global commitments.

From its ascension to the UNFCCC in 1992, Seychelles has implemented several Climate Change Activities to meet the requirements of the convention.

These enhanced requirements from the UNFCCC involve new methodologies and approaches that require countries to have the technical expertise to implement the agreements. A Small Island Developing State (SIDS) like Seychelles needs to be able to retain its small pool of experts to continuously develop and upgrade its technical capacity to achieve its obligations to the convention as well as its Greenhouse Gas (GHG) emissions reduction goals and targets in the short to medium term.

Over the last decade, Seychelles has implemented multiple Climate Change (CC) projects and activities with the assistance of numerous international donors, primarily through grant financing. These funding opportunities have been made possible through multilateral and bilateral agreements. Because of its small size and limited capacity, Seychelles has to constantly seek international assistance in financial, capacity building, technical, and technological transfer in the short to medium term.

However prosperous Seychelles has been in accessing funding for many CC projects and activities, it is still vital to identify its shortcomings along with the gaps and precise obstacles so that in the short term, it can access more funding for CC activities, given the urgency of the climate change effect that SIDS like Seychelles find themselves in.

5.2 Implementation

Ever since the Seychelles ratified the convention, they have embarked on implementing measures towards climate change adaptation and mitigation. Though adaptation is a national priority given Seychelles' vulnerability, most projects implemented have co-benefit for adaptation and mitigation. Since climate change issues are cross-cutting, the Seychelles national climate change policy has initiated a move for a new national institutional framework that will guide climate change governance. Such an approach will facilitate mainstreaming climate change into existing sector policies rather than creating new policies.

Seychelles is geared towards a sustainable, resilient, low-carbon development pathway. However, implementing adaptation and mitigation actions still faces considerable challenges and obstacles to reaching its long-term objectives. These challenges are related to the ineffectiveness of the operational and institutional framework, limited national data-sharing capacity, the low availability of local technical capacity, and limited financial and technological needs. The COVID-19 pandemic has exacerbated these constraints further, but Seychelles has moved forward with a more ambitious Nationally Determined Contribution (NDC 2021) with more ambitious targets.

5.3 Technical and Capacity Building Needs

An overview of the current technical and capacity-building support needs, together with the activities implemented in cross-cutting focus areas (between 2012 and 2020), were compiled from a wide range of CC stakeholders and are provided in the table below. It is a mixture of technical capacity needs to be documented from previous support programs received, complemented with the stakeholders' assessment of technical capacity needs (Table 5-1).

5.4 Identified Technical Capacity Needs

Table 5. 1: Technical capacity needs and their status for mitigation, adaptation and cross-cutting issues

Reporting period: 2012-2020				
Activity	**Focus (Mitigation, Adaptation, Cross-cutting)**	**Support Needed**	**Additional Information on Required Support**	**Status**
Inclusion of Climate Change and mainstreaming it in the training programs of the National Institute of Health and Social Studies (NIHSS)	Cross-cutting	The Global Climate Change Alliances (GCCA) project to support the NIHSS aims to provide support to the institution to include climate change considerations in its training programs. Support of technical climate consultants is needed to assist and support the ministry in integrating climate change into its programs	The overall aim is to ensure that the NIHSS joins the body of organizations, and institutions in Seychelles to prepare themselves against the national impacts of climate change, with each organization doing its part to contribute to the national outcome. This can only be achieved if climate change is factored into every aspect of national development and socio-economic activities.	Completed
Technical capacity building of local stakeholders for coastal ecosystem-based adaptation.	Adaptation	Strengthening the climate change resilience and adaptive capacity of communities and societies in SIDS with high dependence on ecosystem services provided by healthy tropical coastal ecosystems	Develop socio-ecological climate change scenarios and cost-benefit analysis using existing data.	Planned
Seychelles National Climate Change and Health Adaptation Plan of Action 2014-2018	Adaptation	Identifying country-specific health risks associated with climate change in all African countries. Strengthening core national capacities that enable health systems to prepare for and effectively respond to climate change threats to human health. Facilitating the implementation of integrated essential	The Seychelles National Climate Change and Health Adaptation Plan 2014-2018 provides a reference point for multi-sectoral management of climate-sensitive health risk factors impacting on climate-sensitive diseases. Financing and implementation of this plan estimated at USD10 million over five years is	Completed

		public health and environment interventions for managing both short- and long-term health risks resulting from climate change. To-promote operational and applied research on local health adaptation needs and solutions.	hence a joint responsibility of the Ministry of Health, Ministry of Environment and Energy, and other relevant partners, including international and civil organizations.	

5.5 Financial Needs

Access to climate financing is critical to national climate actions, reporting requirements, and implementing the convention's agreement. Reporting to and compliance with the COP is becoming more frequent and a standard to meet the Enhanced Transparency Framework (ETF) of the Paris Agreement (PA).

Funding from the GEF for the BUR and other reporting requirements is still the central overall budget that Seychelles uses for the reporting. Development, approval, disbursement, and the process of preparing the BUR are lengthy. The fund has to be in sync with the country's reporting schedules. As mentioned previously, an effective Measurement, Reporting, and Verification (MRV) system for the Seychelles would make this process more efficient in tracking the funding and meeting the reporting schedules so that the Seychelles meets its obligations promptly.

A sustainable, climate-resilient and low-carbon Seychelles is the vision of the climate policy. The implementation of the mandates of the UNFCCC, as per Seychelles' vision, is a daunting task for a SIDS. The funding estimate from the NDC for the implementation of mitigation actions and projects across cross-cutting focus areas is USD 331.5 million for Mitigation actions and USD 388 million for Adaptation actions. For a small island developing state, Seychelles is highly vulnerable economy to external shocks. The pandemic has created an economic downturn from which Seychelles are still slowly recovering. The transition to a low-carbon economy will need the support of international financial institutions, donors, and pledges made by Annex-1 countries to increase the availability of funds for Non-Annex 1 countries to implement their NDCs. The NDC presents the national areas that require funding for mitigation actions as part of the low-carbon transition. Table 5.4.1 presents the financial needs identified with a primary focus on adaptation activities.

Table 5. 2: Financial needs identified and their status for mitigation, adaptation and cross-cutting issues

Activity	Focus (Mitigation, Adaptation, Cross-cutting)	Support Needed	Additional Information on Required Support	Status
Prepare a coastal Conservation and Flood Management and implementation plan.	Adaptation	The management plan needs are mainly as structural measures for short and middle-term ones and as non-structural measures for middle and long team ones against the impacts of economic development and the ongoing climate change effects being felt by the country in the future	As a matter of course, the plan should be implemented. The plan has to be revised because fundamental information was limited and the future is uncertain such as the estimation of the impact of climate change. For the uncertainty, the plan should be revised at specific intervals with the use of adaptive management system by the monitoring and evaluation of the results by the Ministry of Environment and Energy.	Planned Recommendation by Japan International Cooperation Agency (Jica)
Implement a Drainage Systems Improvement plans	Adaptation/ Mitigation	The drainage channels have been maintained sometimes as desilting activities, and they are effective. The channels have been closing if there is no maintenance because of sediment and debris accumulation. The growth of vegetation and trees is very rapid and causes some kind of obstruction for drainage. A certain amount of budget should be allocated to the MACCE for channel maintenance.	Drainage improvement works have been conducted with the budget of about SCR 6 million in recent years by the CAMS of MACCE for the projects and maintenance. The disaster recovery and related improvement works were budgeted by temporally funds from donors such as the construction works of January flood of 2013. For the coastal prevention there is no fixed budget. In the past, the CAMS applied foreign fund such as RECOMAP and conducted costal works.	Ongoing Recommendation by Jica

Identify the measures required to slow down coastal degradation and erosion processes for Praslin Island.	Adaptation	Needs identified for Coastal degradation and erosion of the following locations in Praslin Island: Anse Kerlan, Grand Anse Cote D'Or, Anse St Sauveur, Anse Consolation, Anse Lazio, Anse Boudin and Anse La Blague	Some proposed measures include: rock armoring, long-term soft measures, beach, and dune management restoration, backshore dune vegetation management and restoration, and rock armoring. The total cost is equivalent to USD 27,440,000	Seeking support from the government and International Donor funds.
Identify~~ing~~ the Coastal degradation and erosion needs for La Digue Island	Adaptation	Needs identified for Coastal degradation and erosion of the following locations in La Digue Island: LaPasse, Anse Severe, Anse Patate, and Anse Gaulette.	Measure proposed are Groynes with sand nourishment plus coral reef management and restoration, Rock Armouring with sand nourishment and backshore dune vegetation management, retaining wall, and backfilling, all estimated to a total of USD 13.210,000	Seeking financing Partners
Identify Costal degradation and erosion needs for Silhouette Island.	Adaptation	Long-term beach erosion more pronounced recently in the Hilton Labriz Hotel area.	Low crested breakwater, groynes, and beach nourishment are proposed measures.	Seeking financing Partners.
Identify Costal degradation and erosion needs for Mahe Island	Adaptation	16 locations identified for beach erosion.	The project total is USD 17,627,689 ~~USD~~.	These 16 project sites are still seeking financing partners for their implementation.

5.6 Identified Technology Needs Assessment and Technology Transfer Needs

Climate change mitigation and adaptation rest on the adoption of the latest and most relevant technologies. Technological transfer hinges on strong technical capacities being available. Over the last decade, different Technical Needs Assessments (TNA) in different CC sectors have been conducted. Many of the TNAs are still very relevant to the current needs of Seychelles.

With the availability of the relevant resources, Seychelles should embark on a regular review to ensure that its technology needs remain updated and relevant to national mitigation and adaptation plans.

Table 5. 3: Technology Needs and Technology Transfer Needs Identified

Technology Prioritized	Activity	Focus (Mitigation, Adaptation, Cross-cutting)	Support Needed	Acceptability to Local Stakeholders	Additional Information on Required Support	Status
Coastal Risk Monitoring & Mapping	Coastal Risk Mapping	Adaptation	A study to identify vulnerability areas for mitigation prioritization, such as Flood Hazard Mapping for approach land use planning in flood-prone areas.	Local coastal engineers, Department of Risk and Disaster Management (DRDM), and land use planners recognize the need for flood hazard mapping and are involved in efforts to date.	Some flood hazard mapping has been done in Seychelles, but in specific locations by different stakeholders. There is a need for more detailed maps and for a complete map of the coastal zones of at least all of the populated islands.	Planned
Coastal Ecosystem Restoration: Dunes & Wetlands	Wetland Restoration	Adaptation	A study to identify ways for rehabilitation and restoration of specific wetland areas across the islands.	Public Knowledge/CAMS	At present, there is an EBA project underway that focuses entirely on the protection and restoration of coastal wetlands. The project focuses on ten sites on Mahé and Praslin, which were chosen following a study of the status of coastal wetlands. This project involves different	Ongoing

					activities at different sites but includes mangrove planting, clean-ups, installation of culverts to improve water flow between fragments of a large mangrove, etc. The project funding is limited, however, and there may be further actions required and recommended as the initial work is implemented.	
	Dune Rehabilitation	Adaptation	A study to assess all adaptation technologies and their feasibility in the Seychelles' context for dune rehabilitation.	Not all adaptation technologies will be equally attractive to all stakeholders for political, economic, social, and cultural reasons. Dune restoration might meet with public resistance in areas where people are used to parking their cars or getting direct access to the beach. A well-planned public awareness campaign will be essential.	Dunes in Seychelles tend to be very narrow strips of land between the beach and coastal wetlands. There have been several projects implemented to revegetate dunes and restrict human activity through the placement of bollards and other structures. There have been several attempts to rebuild the dunes through the placement of a double layer of timber pilings and geotextiles and sloped rock armoring, both of	Planned

					which were coupled with the planting of native vegetation on the landward side to stabilize the dune. These efforts have met with mixed success and there is a need to explore the best technologies for dune rehabilitation.	
Centralised Bio digester	Power Grids Regulations Technologies	Mitigation	Technical assessments of a multi-technology enabling environment for integrating into the power grid.	Public Utilities Corporation (PUC/Seychelles Energy Commission(SEC	Feed-in-Tariffs for renewable energies	Planned
Low-carbon cars	Transition to low-carbon vehicles	Mitigation	A study to identify the enabling conditions for promoting low-carbon vehicles through private sector involvement.	Seychelles Land Transport Agency (SLTA)/ SEC	Number of vehicles transition to a low-carbon vehicle, to promote electronic vehicles.	Planned

Utility-scale PV (MW scale) system with storage	TNA Report Energy Sector	Mitigation	Develop a sizeable scope for the scaling up of utility-scale PV in Seychelles. Technical assistance is needed to investigate the best pathway for the integration of renewables into the grid and also to understand the network with the integration of battery storage.	PUC/SEC	To meet the following pathways •5MW PV (no storage) to be installed 2017 • 4MW PV (no storage) to be installed 2018 • 2MW PV plant on Romainville Island in 2018 • 1MW PV plant on Praslin in 2018 • 4MW battery storage installed on Romainville in 2020 • 1MW battery on Praslin in 2025 Estimate Cost for implementation • USD 24m (PV) • USD 500,000	Ongoing
Insulation in buildings			• Technical assistance to formulate a proposal for a green building code to incorporate insulation in buildings with cooling systems with roof space insulation. •		The estimated cost for implementation is USD 15,000 per building.	Ongoing

Agro forestry (food and energy crops)			Technical assistance is needed for executing a project in biomass energy generation.		The proposed technology support was estimated at USD 20m for the plant and USD 5m for feedstock.	Ongoing
Waste-to-energy			Technical assistance is required to prepare documents for an international tender for a centralized anaerobic digestion unit to be built very close to the current landfill.		Launch project for a 4MW WtE project in 2017. The operation was scheduled for 2019 with an estimated cost of USD 15m.	Ongoing
Waste heat recovery at the Roche Caiman power station for power generation			Technical assistance is required to conduct a study to assess the feasibility of using waste heat from power generation during thermal combustion of fuel oil for further power generation using steam cycle generation.		A feasibility study was carried out in 2017, 5MW of heat was recovered for power generation in 2020, and a scheduled feasibility study to be conducted (7MW recovered) in 2028. Estimated Cost for the feasibility study is USD 5m	Ongoing

Efficient public transport system	TNA Report Energy Sector	Mitigation		PUC/SEC	• Bus management plan drafted in 2016 • This is implemented at the end of 2018 • 2 % Savings in diesel in 2017 • Proper feasibility study and infrastructure analysis during 2016-2017 • Decongestion of Victoria. The Estimated costs are as follows; • USD 100,000 for software • USD 1.5m for hardware	Ongoing
Low-carbon private car fleet (including government vehicles, and taxis) (mix of hybrid & electric)			Assistance with the review of the financial incentives to prevent subsidizing measures that have no net impact on fuel consumption.		Incentive systems put in place to scale up the use of electric cars, hybrid cars, and other vehicles running on other fuels. It is assumed that the average distance traveled by cars in Seychelles is 10,000 km per year. Estimation of cost in USD1.25m (setting up of revolving fund to speed uptake)	Ongoing

Electric scooters			Assistance with the formulation of a financial mechanism to promote scooters as an alternative to fuel-based two-wheelers.		• Feasibility studies in 2018 • Financial mechanism in 2018 • Increase of 100 electric scooters on the roads per year till 2030 The scooters will travel on the same road as the cars and will displace commuting typically carried out using gasoline-powered vehicles on the road. Each scooter will travel approximately 3,000 km per year. Estimate Cost in USD150,000 for incentive program (loss of tax income for the government.)	Ongoing

5.7 Needs Analysis

Seychelles needs were identified to be able to document and address the gaps that exist for it to achieve its CC goals and objectives. These needs have been documented under the Financial, Technical Capacity, and Technological Support Needs.

Priority Areas for action: Access to climate financing for specific adaptation and mitigation projects; improvement of the national CC institutional framework; targeted capacity building of national experts to meet the enhanced transparency framework requirements of the convention.

CHAPTER 6 ANY OTHER INFORMATION CONSIDERED RELEVANT TO THE ACHIEVEMENT OF THE OBJECTIVE OF THE CONVENTION

6.1 Introduction

According to Decision 2/CP.17, Annex 3, Para 2 (g), the scope of BURs includes providing an update on Any other information that the non-Annex I Party considers relevant to the achievement of the objective of the Convention and suitable for inclusion in its Biennial Update Report (BUR). Following this provision, this chapter captures an overview of a collection of additional initiatives over and above those reported in the preceding chapters that have been undertaken to address climate change in Seychelles. It also contains information and success stories from the transformational climate change policy and strategy initiatives on climate change, the drive for the renewable energy sector, the preparation of a National Adaptation Plan (NAP), the International Solar Alliance (ISA) collaborative platform, the Access Climate Finance through International Cooperation and Initiatives, the Stakeholder Engagement and Private Sector Participation in Climate Change Response, etc. A section on the ocean-climate-based sustainable development agenda is also included.

6.2 Transformational climate change policy and strategy initiatives on climate change

Given the cross-cutting nature of climate change and its challenges to national development, a new climate change policy was approved in May 2019 by the Seychelles' Cabinet of Ministers by establishing a framework approach. The approach used in developing the climate policy has avoided duplicating targets and objectives from existing sector policies. The approach has also avoided extracting climate change elements from existing sector policies but instead reinforced them. The benefit of such an approach is to reduce climate change contradictions in sector policies. The policy is also contributing to the regional and international commitment to build climate change resilience by taking into consideration Seychelles' obligations under the international conventions (particularly the UNFCCC) and helping it to achieve the Sustainable Development Goals (SDGs), with particular emphasis on SDG 13 on Climate Action.

The policy has also provided a coordinating mechanism by setting up a National Climate Change Council (NCCC) and a supporting Secretariat. The Council will ensure that every sector mainstreams climate change in its agenda and review and provide advice on legislative, policy, and other measures appropriate for climate change adaptation and mitigation. It will also oversee the implementation of the National Climate Change Strategy (NCCS). It will advise on funding opportunities and appropriate public education and awareness on climate change, coordinate technical assistance on climate change actions, coordinate national and international negotiations on climate change, and ensure reporting and implementation of outcomes on all climate change-related activities undertaken nationally, regionally, and internationally.

The National Climate Change Strategy of 2009 is presently being updated. During a second stakeholder workshop that occurred in December 2021, it was suggested by the stakeholders that the implementation action for this updated strategy should be aligned with the Seychelles' updated NDC 2021. As such, the action plan for this revised strategy is organized into three key areas: mitigation actions, adaptation actions, and cross-cutting issues for action. Furthermore, the timeline of the 2030 targets and the budget estimates for the updated NDC are incorporated in this revised and updated strategy since these targets can be verified if they are achieved or not.

This revised strategy seeks to promote mainstreaming climate change into sectors more coherently to ensure that progress made can easily be monitored by the MACCE.

Additional strategic objectives were proposed while building on the five strategic objectives of the 2009 strategic document through a comprehensive review by stakeholders during the second workshop in December 2021. The new set of objectives will enable Seychelles to achieve its NDC commitments and National Climate Change Policy vision – a sustainable, climate-resilient, low-carbon Seychelles.

The revised and updated national climate change strategy also presents cost estimates and action plans for mitigation and adaptation activities to be achieved by 2030, as indicated in the Seychelles' updated NDC 2021.

6.3 NDC Partnership's Climate Action Enhancement Package (CAEP)

Under the NDC Partnership's Climate Action Enhancement Package (CAEP) initiative, several vital organizations, e.g., the World Bank, the European Union, IRENA, UNDP, and GIZ, delivered targeted support for the enhancement and implementation of Seychelles' NDC through the provision of in-country technical expertise. Seychelles received support from the World Bank, the European Union, and UNDP to review its NDC, energy policy and energy legislation, the mitigation and adaptation components, and to enhance the quality, increase the ambition, and implement the NDC.

The pandemic, however, provided the country with an opportunity to take a step back to assess Seychelles's progress under the Climate Action Enhancement Package (CAEP) of the NDC Partnership program.

6.4 Drive on Renewable Energy

As a Small Island Developing State (SIDS), Seychelles has already embarked on the path to embrace renewable energy for its sustainable development. One important initiative to facilitate this process is formulating and adopting the new energy legislation. It has helped to modernize the energy legislation in Seychelles. For the first time, individuals can produce their electricity using renewable energy technology.

The new Energy Legislation (Energy Act) and policy framework have supported the adoption of renewable energy technologies and grid-connected rooftop photovoltaic systems in particular, designing and implementing financial mechanisms that will make the purchase and installation of solar PV systems more attractive to Independent Power Producers. So, the Energy Act has created a more dynamic market for stimulating energy efficiency and encouraged the import of more efficient appliances into Seychelles.

6.4.1 Green Investment in Renewable Energy

The Government of Seychelles felt that the green investments built around renewable energy, sustainable transport solutions, and nature-based rehabilitation could deliver many additional green jobs and increase the percentage of value addition in the economy.

Seychelles recognizes the importance that it has to place on Renewable Energy as a catalyst for development. It believes that bilateral and multi-lateral partners like the World Bank and IRENA, to name a few, have the ideal expertise through which they could assist Seychelles in coming up with an energy framework to facilitate the desired transformation to a low-carbon society.

6.4.2 International Solar Alliance (ISA) Collaborative Platform

The International Solar Alliance (ISA) became a legal entity on 06 December 2017, and by that time, the framework agreement had been ratified by 19 countries, including Seychelles. The ISA has been conceived as an action-oriented, member-driven, collaborative platform for increased deployment of solar energy technologies to enhance energy security and sustainable development and to improve access to energy in developing member countries. The ISA recognized that sustainable development, universal energy access, energy security and renewable energy be made affordable to all and are critical to our planet shared prosperity and future. In this respect, ISA has been continuously working towards coordinating joint and collaborative efforts to mobilize more than USD 1000 billion in investments in the solar sector by 2030, thereby facilitating the scaling-up of solar deployment in various member countries.

As a member of the alliance, Seychelles support the ISA's three ongoing programs: facilitating affordable finance for solar, scaling up solar applications for agriculture, and promoting solar mini-grids in member countries.

ISA intends to provide technical and financial assistance up to USD 50,000 to forty-seven LDCs and SIDS member countries for implementing solar-based pilot projects across three themes viz. ISA CARES Initiative, ISA Solar Water Pumping Programme, ISA Solar Cold-Storage Initiative, or any other innovative solar project.

The Government of Seychelles has seized this opportunity to submit a project proposal for the installation of 1 solar-powered cold storage unit with a capacity of 10 MT for the benefit of the agricultural community. If successful, the project can later be scaled up by the Government of Seychelles.

6.5 Ocean-climate-based Sustainable Development Agenda

Seychelles Blue Economy Strategic Framework and the Blue Economy Roadmap, approved by the Government of Seychelles on 31st January 2018, is an integrated approach to ocean-based sustainable development that brings together the economy, the environment, and society, consistent with the Sustainable Development Agenda 2030 (SDGs), Aichi Target 11 of the Convention on Biological Diversity (CBD) and the Paris Agreement on Climate Change (2015).

It articulates Seychelles' Blue Economy Brand as a unique comparative advantage based on sustainability credentials. It builds on Seychelles' national and international legal and policy frameworks and the successful flagship initiatives such as marine spatial planning and innovative finance. It puts forward a prioritized agenda for action and investment to 2030.

At COP26, Seychelles, being a large oceanic state with an Exclusive Economic Zone (EEZ) of 1.375 million square kilometers, urged the international community to recognize that the ocean and climate cannot be treated separately. There is a need for concrete ocean-climate action. Seychelles is ready to provide models and examples of what can be done. Most recently, Seychelles committed to pioneering new technologies to map seagrass ecosystems across its entire EEZ. Subject to external support. The country will further build upon its existing work to protect 30% of its EEZ by protecting at least 50% of its coastal wetlands by 2025 and 100% by 2030.

Such initiatives go beyond reaching climate goals to securing the same environment upon which Seychellois depend for their food, livelihood, and development. In fact, these nature-based solutions are effective in securing livelihoods, building the resilience of the economy, and contributing to food security. It must feature prominently in the African Union Green (and Blue) Recovery Plan and the Joint Action Plan. The COP27, the African COP, is the next climate milestone, and Parties must maintain the momentum on ocean and climate action. But it is not the only opportunity, as 2022 is also meant to be a Super Year for the Ocean during which the climate-biodiversity-ocean nexus can be addressed.

Seychelles has been invited to be one of the patrons of the UN Ocean Decade Alliance. The success of the implementation of the UN Ocean Decade Alliance will, to a considerable extent, depend on tangible commitments from UNESCO's member states.

Finance for climate action remains an enormous challenge, but finance for ocean-climate action is equally challenging to access. SIDS cannot iterate enough the importance of finance for ocean-climate action, which must be adequate, consistent, and accessible for developing countries. For SIDS, which falls within the high-income category as per the World Bank classification, their access to finance is even more curtailed. Therefore, such countries, typical of Seychelles, have had to turn to blended finance to support their ocean-climate ambition. Seychelles led the world's first debt-for-nature swap for ocean conservation and climate adaptation and the world's first sovereign blue bond. Seychelles is open to transparent sharing of its experiences so others can benefit from the lessons learned.

6.6 Preparation of National Adaptation Plan (NAP)

Seychelles has a predominantly service-based economy that relies heavily on climate-sensitive economic sectors such as tourism, agriculture, and fisheries. These sectors are particularly vulnerable to the current and future effects of climate change. Specifically, the increasing air and sea temperatures, rising sea levels, increasing rainfall variability, and the growing intensity and frequency of extreme weather events, including droughts, mudslides, and tropical cyclones, are negatively impacting tourism operations and reducing fishery yields, thus threatening the local population, the environment, and the economy. To adapt to these climatic effects, sustainable, climate-resilient planning is required in Seychelles, based on a firm scientific understanding of climate change and an adaptive approach to governance and climate financing.

To date, the Seychelles has made some progress toward planning for the sustainable management of climate change impacts. For example, the Government of Seychelles (GoS) has developed its Nationally Determined Contribution (NDC), the Seychelles National Climate Change Strategy (SNCCS), the Seychelles Sustainable Development Strategy (SSDS), the Seychelles National Development Strategy 2019–2023 (NDS) and the National Climate Change Policy (NCCP). These guiding documents define the national climate change situation and identify national priorities for adaptation. The NDC also identifies barriers to developing and implementing a long-term vision for reducing the impacts of climate change. These barriers include but are not limited to i) education and awareness, ii) research and monitoring, iii) technical capacity, and iv) institutional capacity and legislation.

The above-described barriers and challenges have been used to formulate a comprehensive list of barriers constraining the advancement of Seychelles' adaptation planning (NAP) process that will be addressed through the proposed project under the MACCE.

The proposed Green Climate Finance Readiness and Preparatory Support project intends to address the barriers to sustainable adaptation planning by strengthening the capacity of the GoS at the national, district, and community levels to advance the NAP process. The proposed project's main objective is to reduce the vulnerability of Seychelles' population to climate change impacts through capacity-building for planning, implementing, and monitoring adaptation interventions in a gender-equitable manner. This project will be implemented in line with the United Nations Framework Convention on Climate Change (UNFCCC) NAP Technical Guidelines developed by the Least Developed Countries Expert Group (LEG). In this context, activities will be implemented according to the four outcomes listed below.

1. Adaptation planning governance and institutional coordination strengthened.

2. Evidence is produced to design adaptation solutions for maximum impact.

3. Private sector engagement in adaptation catalyzed.

4. Adaptation Finance increased.

Without GCF resources, the GoS will continue to be inadequately prepared to adapt to the impacts of climate change. They will not have the capacity to learn from their experiences in transitioning towards climate-resilient development. In particular, policy and decision-makers will not have the necessary scientific data or social, environmental, and economic information to make informed decisions about adaptation planning.

The table below (Table 6-1) presents a list of previous, ongoing, or planned complementary projects approved by the international climate change financial mechanism that has a direct link to the NAP Readiness Proposal for Seychelles.

Table 6. 1: Linkages with previous, ongoing, or planned complementary projects particularly with the NAP Readiness Proposal.

Funding Agency	Title of the Project	Delivery Partner or Executing Entity	Date	Project Objective and Complementarity with the NAP Readiness Proposal	Status
Adaptation Fund	Ecosystem-Based Adaptation to Climate Change in Seychelles	UNDP	2014–2022	This project increased the resilience of Seychelles residents to water scarcity and flooding, particularly within the coastal zone. This was achieved through implementing Ecosystem-based Adaptation (EbA) interventions, such as ecosystem restoration. This NAP Readiness Proposal complemented existing work undertaken in this project by assessing water scarcity and the flooding threats of urban settlements in the climate risk assessments.	completed
Adaptation Fund	Restoring marine ecosystem services by rehabilitating coral reefs to meet a changing climate future (Mauritius, Seychelles)	UNDP	2020–2025	This project will enhance the ecosystem functioning of critical marine biodiversity areas in Mauritius and the Seychelles through EbA techniques to restore degraded coral reefs across both countries. It is envisioned that project activities will result in greater capacity for future EbA, as well as improved food security and resilience to potential natural disasters amongst beneficiaries.	Ongoing

Green Climate Fund	FP135: Ecosystem-based Adaptation in the Indian Ocean – EBA IO	Conservation International	2020–2031	Four program countries will be targeted under this project, namely: Comoros, Madagascar, Mauritius, and the Seychelles which will introduce EbA interventions to preserve and restore ecosystem service provision of key ecosystems within biodiversity hotspots in the target countries. This will be achieved through, *inter alia*, engagement with Civil Society Organisations (CSOs) to deliver EbA to vulnerable communities as well as creating strategic plans for EbA in target biodiversity hotspots. Under Component 2 of FP135, CSOs will be allocated grants to implement EbA in appropriate locations that will contribute to this Readiness proposal through, *inter alia,* strengthening the capacity of key institutions for climate change adaptation.	Ongoing
Green Climate Fund	FP161: Building Regional Resilience through Strengthened Meteorological, Hydrological and Climate Services in the Indian Ocean Commission (IOC) Member Countries	Indian Ocean Commission	2021–2026	This project aims to improve climate change resilience by developing and implementing multi-hazard early warning systems in each of the four target countries — Comoros, Madagascar, Mauritius, and the Seychelles. This tool, accompanied by training and capacity building of appropriate institutions, will allow decision-makers and beneficiary communities to increase their awareness regarding climate change and make more informed decisions that will ultimately improve their resilience.	Approved

				This NAP proposal will build on several of the components included in FP161, particularly Components 1 and 2. Component 1 will, *inter alia*, create a regional climate data service that will contribute to establishing an evidence basis for climate change adaptation.	
World Bank	Pilot Testing the Development of a Blue Barrier	DBS/SEYCATT	2018–TBD	The World Bank issued the first 'blue bond' to the Republic of Seychelles in 2018, valued at USD18 million. This bond will be used to finance Seychelles' transition to 'sustainable fisheries and the protection of marine areas,' with a focus on expanding marine protected areas, establishing Seychelles' blue economy, and improving fisheries governance. The issuance of this blue bond contributes to this Readiness proposal by facilitating increased adaptation finance (NAP financing) as well as by engaging with private sector investors who contributed to the blue bond.	Ongoing
GEF	Development of Seychelles Second National Communication	UNDP	2008–2011	The main objective of this project was to develop Seychelles' Second National Communication (SNC) as well as several other priority documents, including i) a National Climate Change Strategy and Action Plan, ii) the Seychelles Ocean Temperature Monitoring Network. The project additionally reviewed current school curricula to include information on climate change as well as future 'Education, Training and Public Awareness Activities. This NAP Readiness proposal was built on the climate change adaptation priorities established in the Second National Communication (SNC).	Completed

NDC Partnership	NDC Partnership Plan	World Bank, EU and UNDP	2019–TBD	The Seychelles' NDC Partnership Plan will support the Government of the Seychelles in updating the NDC as well as developing a National Renewable Energy Roadmap and establishing a national monitoring, reporting, and verification (MRV) system. The proposed Readiness project has been developed in close alignment with the targets and objectives of the updated NDC. The priority areas and sectors for the NAP process — as identified by MEPA — were additionally informed by those outlined in the updated NDC.	Ongoing
GEF	Technology Needs Assessment (TNA) Project	UNEP and UNEP DTU Partnership	2018	The Seychelles TNA Project was undertaken to identify i) priority economic sectors for CCA and ii) key CCA technologies to be implemented in said sectors. Water and the coastal zone were identified as key sectors for CCA in the Seychelles, given their economic and social contributions and alignment with the updated NDC. A range of adaptation technologies was assessed for each sector, and between two and three technology options were selected and prioritized under the TNC. This project resulted in, *inter alia,* the development of costed Technology Action Plans for Adaptation and a Barrier Analysis and Enabling Framework for Adaptation.	Completed
Commonwealth Secretariat	Commonwealth Climate Finance Access Hub	Commonwealth Secretariat	Sep 2019–Sep 2021	The Commonwealth Climate Finance Access Hub was designed to facilitate improved access to climate change finance amongst member states, which include the Seychelles. The Hub additionally promotes increased human capacity for accreditation support, policy and climate finance readiness (NAP financing), and the development of project pipelines.	Ongoing

World Bank	Coastal Management Plan (CMP) Development	Ministry of Environment, Energy and Climate	2018–2019	Seychelles' CMP was developed to provide a framework for the maintenance and protection of the coastal zone 'to reduce coastal risk, support healthy ecosystems and enable sustainable coastal economic development'. The document uses a holistic approach to coastal management that engages various stakeholders, including public bodies such as the Town and Central Planning Authority, the Land Transport Agency, and Seychelles National Parks Authority. This Readiness proposal was built on the priorities outlined in the CMP.	Completed
	Coastal Management and Adaptation Finance Roadmap for Seychelles	Ministry of Environment, Energy and Climate	Sep–Dec 2021	This project will build on the CMP Development project detailed above and support the ongoing implementation of Seychelles' Coastal Management Plan (2019–2024). A Coastal Management and Adaptation Finance Assessment will be conducted to inform a Financial Roadmap that will include suitable financing opportunities for Seychelles' coastal zone.	Planned

6.7 Access Climate Finance through International Cooperation and Initiatives

Accessing climate finance through international cooperation and initiatives is an essential prerequisite in achieving ambitious climate targets represented by the NDC. Access to climate finance by Seychelles can be considered an iterative process comprising different stages the country is presently embarking upon. Increased ambitions of its NDC cannot be realized if Seychelles does not effectively address challenges such as a varied, fragmented financing architecture and stringent procedures that do not consider local conditions and expectations.

6.8 Stakeholder Engagement and Private Sector Participation in Climate Change Response

Seychelles has a proactive environmental NGO community that is actively engaged in initiatives related to environmental and climate change issues. NGOs, such as Sustainability for Seychelles (S4S), the Green Islands Foundation (GIF), Nature Seychelles, and the Island Conservation Society, collect environmental data that can be used to inform decisions and policy-making. Many of these NGOs have exceptional working partnerships with the private sector, particularly among tourism operators that support their initiatives. They have also collaborated with the GoS and local media to organize numerous awareness-raising events. However, the resources and capacity of these NGOs are often underutilized, and limited coordination between NGOs and government institutions restricts their potential to contribute to climate change adaptation across the country. For example, participation from newly-formed NGOs such as SIDS Youth Aims Hub Seychelles (SYAH-Seychelles) is yet to feature prominently within the NCCC. Structured involvement of NGO groups in government/institutional initiatives may improve efficiency by ensuring that government and other integral partners remain accountable for regional, national, and international obligations. The GoS aims to achieve this by committing to engaging with NGOs and Civil Society Organisations, as stated as a specific objective of the NCCP.

Private sector participation in climate change response is another gray area requiring improvement. This ineffective participation from the private sector is attributed to inadequate institutional and technical capacity to integrate climate change preparedness and resilience into their business portfolio. Some of the critical factors adversely affect private sector participation and, in particular, Small and Medium Enterprises (SMEs) development are:

I. Lack of access to finance as well as appropriate financial instruments for enterprises of different sizes;

II. Insufficient access to technology, knowledge, and training;

III. Insufficient access to markets, especially beyond local markets, and market information;

IV. Limited information on business opportunities presented by climate change;

V. Inadequate incentives to attract private sector investments.

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