Republic of Vanuatu's First Biennial Transparency Report

Under the Vanuatu's First Biennial Transparency Report to United Nations Framework Convention on Climate Change (UNFCCC)

Submitted by:

Ministry of Climate Change, Republic of Vanuatu

Executive summary

This inaugural Biennial Transparency Report for Vanuatu serves as a comprehensive overview of the nation's efforts to meet its commitments under the Paris Agreement. It encompasses critical aspects of Vanuatu's national circumstances, greenhouse gas (GHG) inventory, progress tracking for nationally determined contributions (NDCs), climate change impacts and adaptation strategies, as well as financial and technological support needs and responses related to climate change. Additionally, the report addresses initiatives aimed at averting, minimizing, and addressing loss and damage associated with climate change impacts.

I. National Circumstances and Institutional Arrangements

Vanuatu's unique geographical and socio-economic context is characterized by its status as a small island developing state (SIDS), facing significant vulnerabilities due to climate change. This section outlines the institutional frameworks in place to facilitate climate governance, including coordination mechanisms among government agencies, civil society, and local communities. The report emphasizes Vanuatu's commitment to integrating climate action into national development plans, promoting resilience, and ensuring sustainable development.

II. National Greenhouse Gas Inventory

The national GHG inventory provides a detailed assessment of emissions sources across key sectors, including energy, agriculture, and waste management. It highlights the challenges of data collection in a small island context while showcasing efforts to improve accuracy and comprehensiveness. The inventory serves as a baseline for Vanuatu's GHG emissions, essential for tracking progress and informing future climate policies.

III. Progress on Nationally Determined Contributions

This chapter outlines Vanuatu's NDCs, focusing on renewable energy targets, emission reduction goals, and climate resilience initiatives. The report presents progress made towards these targets, including capacity-building measures, stakeholder engagement, and policy implementation. It identifies barriers faced in achieving NDCs and outlines strategies for overcoming these challenges.

IV. Climate Change Impacts and Adaptation

Vanuatu is experiencing a range of climate change impacts, including sea-level rise, extreme weather events, and biodiversity loss. This section discusses the nation's vulnerability assessments and adaptation strategies, including community-based adaptation practices and infrastructure resilience initiatives. The report emphasizes the need for ongoing investment in adaptive capacity to mitigate the adverse effects of climate change.

V. Financial, Technology Development, and Capacity-Building Support

Vanuatu's financial and technological needs for climate action are critical to achieving its climate goals. This chapter assesses the support received under international frameworks and outlines the gaps in funding and technology transfer necessary for effective climate action. It emphasizes the importance of strengthening partnerships and securing resources to enhance the nation's capacity to respond to climate change.

VI. Averting, Minimizing, and Addressing Loss and Damage

The report examines Vanuatu's approach to loss and damage associated with climate change impacts, including strategies for risk reduction and recovery from climate-related disasters. This section highlights the importance of integrating loss and damage considerations into national planning and emphasizes the need for international cooperation and support to address these challenges effectively.

In summary, Vanuatu's First Biennial Transparency Report reflects the nation's commitment to transparency and accountability in its climate actions. It underscores the interlinkages between sustainable development, adaptation, and mitigation, and highlights the critical need for continued support from the international community to achieve the nation's climate goals effectively.

Abbreviations

AFOLU	Agriculture, Forestry and Other Land Use
CH_4	Methane
CO	Carbon Monoxide
CO_2e	Carbon Dioxide equivalent (also for CO2-eq)
CRT	Common Reporting Tables
DoCC	Department of Climate Change
DoE	Department of Energy
FAO	Food and Agriculture Organization
Gg	Giga Gram
GHG	Greenhouse Gas
GoV	Government of Vanuatu
GWP	Global Warming Potential
HFCs	Hydro Fluorocarbons
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product use
LPG	Liquefied Petroleum Gas
MPG	Modalities Procedures and Guidelines
N_2O	Nitrous Oxide
NGOs	Non-Governmental Organizations
NMVOC	Non-methane volatile organic compounds
NOx	Oxides of Nitrogen
PA	Paris Agreement
TNC	Third National Communication
VUI	Vanuatu Utility Infrastructure

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I. National Circumstances and Institutional Arrangements

National Circumstances and Institutional Arrangements

Introduction

Europeans first arrived in Vanuatu in the early 17th century, with James Cook naming it "New Hebrides" in 1774. The nation gained independence on July 30, 1980, after 74 years under an Anglo-French Condominium. Bislama is the national language, alongside English and French as official languages. With over 100 distinct languages, Vanuatu is one of the world's most linguistically diverse countries.

Situated in the South Pacific, Vanuatu spans 12°–23°S and 166°–173°E. It comprises 12,336 km² of land, a 2,528 km coastline, and a 680,000 km² Exclusive Economic Zone rich in marine resources. Neighboring Fiji, the Solomon Islands, and New Caledonia, it occupies a key regional location.

Climate change is a top priority for the Government of Vanuatu, underscored by the declaration of a climate emergency by the National Parliament in May 2022. Vanuatu has also emerged as a leading global advocate for seeking an advisory opinion from the International Court of Justice on climate change responsibilities. The country is highly vulnerable to climate risks, frequently ranking in the top quartile for exposure to such risks. According to the Germanwatch 2021 report, Vanuatu ranked 37 out of 180 countries for loss of life and economic damage due to climate-related disasters between 2000 and 2019. Recent Category 5 cyclones, including Cyclone Pam (2015) and Cyclone Harold (2020), have caused significant destruction, highlighting Vanuatu's vulnerability to extreme weather events. Additionally, the country's population growth plays a key role in driving energy demand and emissions.

Vanuatu's population has grown at an average rate of 2.3% per year over the past three decades, driving increased energy demand and emissions through greater residential services, transport, and waste production. This growth rate is among the highest in the Pacific, second only to that of the Solomon Islands. However, a decline in the Total Fertility Rate to 3.2 children per woman, as reported in the 2020 National Population and Housing Census and the United Nations Population Division's projections, suggests that future population growth may slow. Vanuatu’s economy is driven by the services and industry sectors, which include manufacturing, construction, electricity, and gas, as well as retail trade, transportation, and government services. While the agriculture, forestry, and fisheries sectors are central to the country's economic structure, they are not major drivers of emissions. Recent economic growth has averaged around 3.95% in real GDP and 3.14% in Gross Value Added (GVA) for the period from 2007 to 2020, reflecting the country’s increasing economic activity in the industrial and services sectors.

In this chapter of the first Biennial Transparency Report (BTR), Vanuatu explores its national context, delving into crucial aspects across several distinct sections to depict the country's current circumstances and pertinent considerations. The report offers detailed insights, incorporating relevant subsections as needed.

Administrative Structure

The Constitution of Vanuatu outlines the nation's identity as a sovereign democratic state, where the sovereignty is vested in the people. This sovereignty is exercised through their elected representatives. The Constitution also sets the foundation for the country's political, judicial, and cultural structures.

President: A ceremonial head of state elected by an electoral college for a five-year term, representing national unity.

Prime Minister: The head of government, elected by Parliament, who appoints the Council of Ministers to form the executive branch.

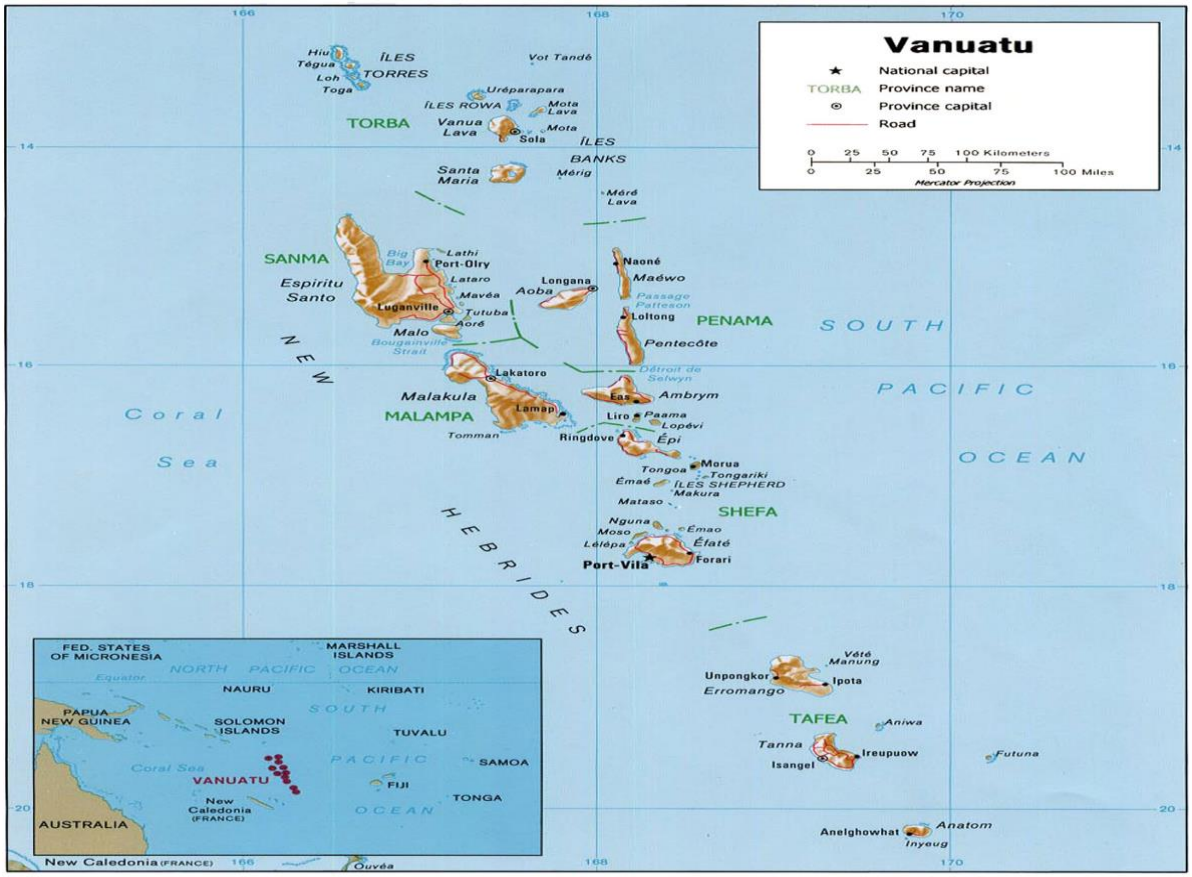
Parliament: A 52-member unicameral body elected every four years, responsible for legislation and government oversight.

National Council of Chiefs (Malvatu Mauri): Advises on ni-Vanuatu culture and language, with chiefs holding significant influence at the local level.

Judiciary: Includes the Supreme Court, Magistrate Courts, and customary law courts, with a legal system based on British common law and French civil law.

Official Languages: Bislama, English, and French are declared official languages. English and French serve as the main languages of education.

Figure 1 Administrative map of Vanuatu. Source: https://www.nationsonline.org/



Geography and Geology

Vanuatu is an archipelago of volcanic islands and submarine volcanoes situated between latitudes 12° and 23° south and longitudes 166° to 173° east. The country spans approximately 1,300 km from its northernmost to southernmost islands. With a coastline of 2,528 km and a land area of 12,336 km², Vanuatu is set within a 200-mile exclusive economic zone (EEZ) covering around 680,000 km². The geography of Vanuatu ranges from low coral atolls to towering volcanic peaks, making it one of the most geographically diverse nations in the Pacific.

Twelve islands are significant in terms of economy and population, with the largest being Espiritu Santo (4,010 km²), Malekula (2,069 km²), Efate (980 km²), and Erromango (900 km²). These islands, particularly Santo and Malekula, constitute 50% of the country's landmass and harbor most of the population. Many of the islands are mountainous, with 35% of the country located above 300 meters in elevation, including peaks such as Mt Tabwemasana (1,879 m), Ambae, Ambrym, and Tanna, which rise over 1,000 meters. The steeper areas are often covered in lush forests, while coconut plantations and other agricultural activities dominate the narrow plains.

Vanuatu emerged from the sea about 22 million years ago due to tectonic movements that created massive underwater mountains. The islands' landmass expanded significantly over

the past two million years due to continued uplift and volcanic activity, which also led to the formation of fringing coral reefs and raised ancient reefs several hundred meters above sea level. The archipelago lies on the Pacific Ring of Fire, where the Pacific tectonic plate is forced over the Indo-Australian plate, causing frequent earthquakes and volcanic eruptions.

The country has nine active volcanoes, seven on land and two underwater, with the most famous being Mt Yasur on Tanna. Volcanic activity continues to create new land, and some areas of Vanuatu are being uplifted at a rate of 2 cm per year, while others are subsiding. Seismographs record frequent earth tremors, and major earthquakes, like the one in 2001 (over 7 on the Richter scale), have caused significant damage. Mt Garet on Gaua is considered the most dangerous, as a thin layer of rock separates its crater lake from molten magma below.

Hydrological Resources

Vanuatu, an archipelago stretching from 14 to 22 degrees south latitude, presents a diverse range of conditions that influence its freshwater resources. Rainfall across the islands is generally abundant, ranging from less than 100 mm per month in July to over 400 mm in January. This variability is more pronounced from north to south, with high mountainous islands creating rain shadows on their leeward sides. In 2006, northern islands experienced 20 to 30 percent more rain than average, while the southern islands received 20 to 40 percent less. Larger islands generally have both groundwater and surface water resources, while smaller islands, such as Mataso and Buninga in the Shepherd’s Group and all of the Torres Group, have neither. In times of national disasters like cyclones, where islands depend on rainwater catchment, the National Disaster Management Office (NDMO) has deployed desalination plants as temporary relief measures.

Urban areas, especially in Port Vila, are increasingly relying on bottled water. Several types of imported bottled water are available on supermarket shelves. Despite past efforts to establish a water resource monitoring system, Vanuatu still lacks a comprehensive water resource database.

Freshwater Use

Freshwater in Vanuatu is sourced from both ground and surface water, primarily for domestic use. In urban centers like Port Vila, shallow aquifers are the main source, while rural areas utilize a combination of bores, wells, springs, rivers, and rainwater catchment systems. Urban water supplies in Port Vila are managed by Union Electrique Du Vanuatu Limited (UNELCO) and in Luganville, Isangel, and Lakatoro, they are handled by Public Works Department. Rural water supplies are typically donor-funded and community-managed.

Vanuatu's tourism industry, both urban and rural, shares the same water supplies as domestic users. Although the industry is underdeveloped, large consumers only account for about two percent of all UNELCO customers in Port Vila. Agriculture, another limited sector, sources water primarily from private and unmonitored bores. Horticultural developments in Port Vila rely on UNELCO’s reticulated water supply.

Groundwater Resources

Information about groundwater in Vanuatu is sporadic and mainly focuses on urban centers like Port Vila and Luganville. Generally, groundwater quality is good, with the only issue beincalcium hardness. Both Port Vila and Luganville aquifers currently only require chlorination for treatment. However, aquifer levels in these urban areas are believed to be declining due to increasing pumping demands.

Studies conducted by Depledge (1994) and Hawkins (1995) found that groundwater in Port Vila was generally good but showed elevated nitrogen levels in isolated areas like Klems Hill market garden, Fatumaru Bay, and the Pango restaurant borehole. Some sites also indicated higher levels of faecal coliform bacteria, particularly in peri-urban areas like Blacksands.

Many areas in Vanuatu hold substantial groundwater reserves, providing a reliable buffer during seasonal rainfall fluctuations. Deep boreholes, drilled to an adequate depth, can supply significant amounts of water even during severe droughts. In comparison, springs or stream sources may dry up during lower rainfall periods.

Surface Water Resources

Surface water quality across Vanuatu has been declining in many areas, though the available data is limited. The Tagabe River, which supplies water to Port Vila, is one of the few monitored rivers. Regular monthly testing by UNELCO highlights high levels of bacteria from human waste, along with elevated chemical oxygen demand (COD) and nitrogen levels. Due to these concerns, the Tagabe River is considered a “hotspot” for contamination.

River

The Sarakata River, flowing near Luganville, provides water from a shallow aquifer and supports hydroelectric power. Despite efforts to monitor it, data collection has been limited. Similarly, the Tagabe River faces threats from contamination. To protect its watershed, the Tagabe River Management Committee and River Protection Action Group were formed, involving local authorities, UNELCO, and NGOs, aiming to safeguard water quality through policies and monitoring.

Environment and Ecosystem

Terrestrial Biodiversity

Seventy-four percent of Vanuatu's land is covered with natural vegetation, showcasing a variety of forest types, including tropical lowland evergreen rainforests, broad-leaved deciduous forests, closed conifer forests, montane rainforests, cloud forests, and coastal forests. Notable vegetation features include swamp forests on Efate, kauri pine strands on Erromango, and approximately 3,000 hectares of mangrove forests, primarily found on Malekula Island.

While much of the lowland forest has been cleared for anthropogenic uses, forested areas continue to dominate the landscape on many islands. High forests are limited in densely populated regions like Pentecost, Ambae, Tanna, and the volcanic island of Ambrym, though

low montane forests are generally well-preserved. Vanuatu is home to around 1,000 vascular plant species, with about 150 being endemic. The island nation boasts significant diversity in orchids, with 158 species, and palms, with 21 species, of which 14 are endemic. The fauna includes 121 bird species, 28 species of reptiles, and 12 species of chiropterans (flying foxes and bats). Invertebrate diversity remains inadequately described but includes the coconut crab (Birgus latro), the largest land crab, which serves as an important food resource. (GOV, 2014)

However, invasive species pose a significant threat to Vanuatu's biodiversity. Notable invasive animals include the Indian Mynah (Acridotheres tristis), the Giant African Snail (Achatina fulica), and the Rosy Wolf Snail (Euglandina rosea). The latter was introduced to control the African snail but has contributed to the extinction of several native snail species elsewhere. Another concerning species is the Little Fire Ant (Wasmannia auropunctata), known to diminish arthropod diversity and potentially threaten crab species, including the coconut crab. Vanuatu has experienced one recorded extinction: the Tanna Ground Dove (Gallicolumba ferruginea), primarily driven by hunting and predation by domesticated and feral mammals.

Inland Waters Biodiversity

Vanuatu's inland waters feature a diverse range of freshwater habitats, including steep gradient mountain streams, crater lakes, and subterranean streams in karst areas. Cave explorations on Santo have discovered four new invertebrate species unique to these environments. Atolls and coral islets often host underground freshwater lenses due to their porous rock structures. The islands contain a network of lakes, rivers, and streams. Rapid mountain rivers and low-gradient streams are prevalent, while Lake Letas on Gaua Island is the largest freshwater body in the Pacific, covering 19 km² and reaching depths of 350 meters. Freshwater swamps and forests are typically found around lakes or in depressions on plateaus.

Vanuatu’s freshwater systems can be divided into six zones based on altitude and water velocity: spring zone (above 800 m), higher course (450-800 m), middle course (150-450 m), upper lower course (50-150 m), and lower course (below 50 m). Most species inhabit low-velocity areas, but unique species thrive in high-velocity reaches, including Sicyopterus from the Gobiidae family. All freshwater fish in Vanuatu are amphidromous, linking freshwater and marine ecosystems. Gobies are dominant, with some endemic species present. However, larger species like eels (Anguilla spp.) and Spot-tail Bass (Lutjanus fuscescens) are more commonly utilized as food sources. Freshwater fish biodiversity can be localized, with small habitats supporting unique species. Of the 96 known crustacean and fish species, five are endemic to Vanuatu, and seven are endemic to both Vanuatu and New Caledonia.

Marine and Coastal Biodiversity

Vanuatu features diverse marine habitats, including inshore coral reefs, deep-water seamounts, and canyons. Coral reefs are categorized into fringing, barrier, and atoll types, supporting a variety of mollusks, crustaceans, and fish that are essential protein sources for coastal communities. Many coral species are globally threatened due to climate change impacts, while threatened fish species include the Humphead Wrasse (Cheilinus undulatus) and Green Bumphead Parrotfish (Bolbometopon muricatum). White sand beaches serve as critical nesting sites for Green (Chelonia mydas) and Hawksbill Turtles (Eretmochelys imbricata).

Seagrass beds in clear waters support Dugongs (Dugong dugon), which have been observed in small groups, particularly in Lamen Bay and Tanna Bay. Mangroves provide essential nurseries for juvenile fish, coastal protection, and carbon sequestration, contributing significantly to ecosystem services. A 2009 study valued 136.5 hectares of mangroves in Crab Bay at USD 586,000 and 31.2 hectares in Eratap at USD 266,000.

Rocky shorelines occur where volcanic islands and steep drop-offs prevent coral development, and locals often collect gastropods from intertidal zones. Overall, Vanuatu's marine and coastal biodiversity generates over VT 4.5 billion in goods and services, including VT 850 million from tourism and VT 160 million from tuna access fees, with additional contributions from subsistence and small-scale commercial fishing, coastal protection, and carbon sequestration (Pascal et al., 2015).

Natural Resources

Minerals

Vanuatu has notable mineral resources, including manganese and precious metals, but lacks the infrastructure for large-scale mining. Manganese has mainly been mined at the Forari Mine, with sufficient grade to support economic excavation. In 2006, Vanuatu Project Management Limited was contracted to export 500,000 tons of previously mined manganese, although no further mining took place.

Agriculture

In Vanuatu, approximately 80% of the population relies on subsistence agriculture, making the sector highly vulnerable to climate change impacts. These impacts threaten food security, as agricultural practices depend heavily on rain-fed systems. Key climate-related risks include changes in precipitation patterns, extreme weather events such as heavy rains and droughts, salinization, increased evapotranspiration, seasonal variability, and reduced freshwater availability. As a result, the agricultural sector faces significant challenges that could jeopardize the livelihoods of many communities.

Forest

Vanuatu's forests cover 36% of its landmass, making the country a net carbon sink and vital to the livelihoods and economic development of its people. Despite their importance, assessments of climate change impacts on Vanuatu's forestry are limited. Projections suggest that changing precipitation patterns, temperature fluctuations, seasonal variability, and increased extreme weather events will place significant stress on various tree species and the overall biodiversity of these forests. This could result in altered ecosystem compositions, reduced plant density, and the potential migration or decline of certain species.

Fisheries

The fisheries sector in Vanuatu is crucial for income generation and food security, especially for coastal communities. However, climate change poses significant threats to both fisheries and marine ecosystems. Rising ocean temperatures can lead to fish population migrations and habitat alterations. Additionally, shifts in ocean circulation patterns may disrupt the aquatic

food web as species search for suitable conditions for their life cycles. Moreover, climate-induced ocean acidification threatens marine environments by reducing calcium carbonate availability, impacting shelled organisms and coral reef calcification.

Climate Profile

Vanuatu's climate varies from wet tropical conditions in the northern islands to subtropical climates in the southern parts of the archipelago. The country experiences significant variations in rainfall due to both its geographic position and topographical features. The northern islands receive an average of over 4,000mm of annual rainfall, while the southern islands see significantly less, with average annual rainfall around 1,500mm.

Vanuatu's rainfall patterns are largely influenced by the South Pacific Convergence Zone (SPCZ), which intensifies during the wet season and moves further south, bringing heavy rainfall across the country. This system of low pressure frequently triggers the development of tropical cyclones during the cyclone season, which spans from November to April. The number of cyclones can vary significantly from year to year; some seasons experience no cyclones, while others may see as many as six.

The country's mountainous terrain also plays a key role in shaping local rainfall patterns. In the wet season, the windward (southeast) sides of the larger islands' mountain ranges receive much higher rainfall, while the leeward (northwest) sides often experience drier conditions, especially during the dry season.

Temperature variations across Vanuatu remain moderate, with annual average temperatures ranging between 23.5°C and 27.5°C. Seasonal temperature fluctuations are closely tied to changes in the surrounding ocean temperatures, which exert a strong influence on Vanuatu's overall climate dynamics.

Overall, Vanuatu's climate is defined by its tropical location, frequent heavy rainfall, and vulnerability to tropical cyclones. The interaction between oceanic systems and the country's rugged geography leads to distinct weather patterns, making Vanuatu particularly susceptible to climate variability and extreme weather events.

Climate Change Trends

Vanuatu has a tropical climate, moderated by southeast trade winds from May to October, with moderate rainfall from November to April, often affected by cyclones from December to April. Climate change trends, monitored by ni-Vanuatu and Australian climatologists under the Pacific Climate Change Science Program, highlight key observations and projections on temperature, rainfall, extreme events, and oceanic conditions, based on data from various meteorological stations across the country.

These observations include the following:

- Maximum and minimum air temperatures have increased significantly at Bauerfield Airport (Port Vila) from 1948 to 2011.
- The November to April and May to October maximum temperatures at Aneityum have also increased over the same period.

- These temperature increases are consistent with global warming trends, reflecting the warming effect of climate change on the region.
- Long-term trends in annual and half-year rainfall show little change at Bauerfield Airport since 1907 and at Aneityum since 1949.
- Extreme daily rainfall trends have also shown minimal changes at both stations since 1945, suggesting that while overall temperatures are rising, rainfall patterns have remained relatively stable.
- Vanuatu experiences tropical cyclones primarily between November and April. From the 1969/70 to 2010/11 seasons, an average of 24 cyclones per decade developed within or crossed Vanuatu's Exclusive Economic Zone (EEZ).
- Twenty-nine of the 71 tropical cyclones (41%) that occurred between 1981/82 and 2010/11 were classified as severe events (Category 3 or stronger).
- Long-term trends in cyclone frequency and intensity remain uncertain due to limited historical data.
- Wind-wave conditions around Vanuatu show little variation throughout the year, with wave heights and periods remaining fairly constant. Waves are typically influenced by the southeast trade winds and the movement of the South Pacific Convergence Zone (SPCZ).
- While wind-wave data are sparse, variability on interannual timescales is linked to the El Niño–Southern Oscillation (ENSO) and Southern Annular Mode (SAM). However, available data are insufficient to assess long-term trends in wind-wave patterns.
- Data on sea-surface temperature, ocean acidification, and sea levels are crucial for understanding Vanuatu's exposure to climate change, though longer-term data on these indicators are still being gathered. Projected increases in sea levels and ocean temperatures will exacerbate Vanuatu's vulnerability to climate impacts, including coastal erosion and threats to marine biodiversity.

Climate Impacts and Vulnerabilities

Vanuatu, as a Small Island Developing State (SIDS), faces significant climate vulnerabilities due to its location, socio-economic conditions, and reliance on natural resources. The country is highly exposed to tropical cyclones, rising sea levels, droughts, floods, and seismic hazards. Positioned within the South Pacific Convergence Zone (SPCZ), it is particularly vulnerable to climate variability, especially during El Niño events. Climate risks include sea level rise, coastal erosion, ocean acidification, and increased cyclone intensity, as seen with Cyclones Pam (2015) and Harold (2020).

The country's geography, with dispersed islands and mountainous terrain, complicates infrastructure development and communication. Key sectors like agriculture, fisheries, and tourism are highly sensitive to climate change, threatening food security, livelihoods, and economic stability. As a Least Developed Country (LDC), Vanuatu's limited financial resources heighten its vulnerability. Ranked as the most at-risk country for natural hazards by the World Risk Index 2018, over 50% of its population is potentially affected by disasters. Coastal areas face severe erosion, and communities on islands like Tegua and Aniwa have been displaced due to these threats, further exacerbated by unsustainable practices and cultural site erosion.

Vanuatu faces significant climate-related vulnerabilities due to its geographic location, socio-economic conditions, and reliance on natural resources as a Small Island Developing State (SIDS). The country is highly exposed to the adverse impacts of climate change, with effects felt across its economy, environment, and communities. Vulnerable to a range of natural hazards such as tropical cyclones, rising sea levels, droughts, and floods, Vanuatu's position within the South Pacific Convergence Zone (SPCZ) increases the risks associated with climate variability, particularly during El Niño

-Southern Oscillation (ENSO) cycles. Additionally, being in a seismically active region, Vanuatu is prone to earthquakes, volcanic eruptions, and tsunamis. Key climate risks include sea level rise and coastal erosion threatening low-lying communities and infrastructure, ocean acidification and rising sea temperatures impacting marine ecosystems and resources like coral reefs and fisheries, and increased cyclone intensity, evidenced by destructive storms like Cyclone Pam in 2015 and Cyclone Harold in 2020.

The country's geographic remoteness, dispersed islands, and mountainous terrain complicate administration, communication, and infrastructure development. The extensive coastline is especially vulnerable to climate-induced erosion, spring tides, and species loss due to coral bleaching, impacting the low-lying areas where most of the population and critical infrastructure are located. Key sectors vulnerable to climate change include agriculture and fisheries, which are essential for food security and livelihoods for about 80% of the population and are highly sensitive to climate variations such as droughts and changing rainfall patterns. The tourism industry, a major economic contributor, is also at risk from extreme weather events and infrastructure limitations, with coastal resorts and attractions vulnerable to rising sea levels and cyclones.

As a Least Developed Country (LDC), Vanuatu's limited financial and adaptive capacity exacerbates its vulnerability to climate change. The World Risk Index 2018 ranked Vanuatu as the most at-risk country globally for natural hazards, with over 50% of the population potentially affected by disasters. This high exposure places immense pressure on the country's infrastructure, economy, and the livelihoods of its citizens. Coastal areas are particularly at risk due to sea level rise and tectonic subsidence, leading to extensive coastal erosion and frequent inundations on several islands. Communities on Tegua, Aniwa, and the Torres Islands have been forced to relocate due to these threats, which are further accelerated by unsustainable practices like mangrove removal and sand extraction. The ongoing erosion of important cultural sites, such as graveyards on Pele Island, Emau Island, and South Santo, underscores the cultural and social impacts of climate change in Vanuatu.

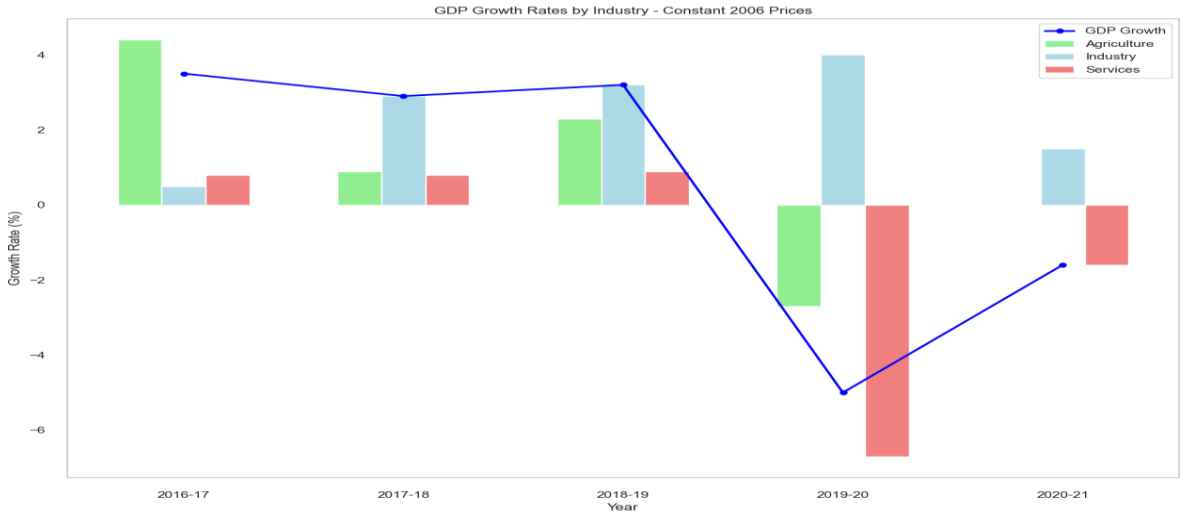
Socioeconomic Profile

Economy

The Gross Domestic Product (GDP) estimation for Vanuatu in 2021, undertaken by the Vanuatu Bureau of Statistics (VBoS) (2023), reveals significant insights into the nation's economic performance amidst ongoing challenges.This preliminary report focuses on GDP derived from both production and expenditure estimates in current and constant (real 2006) prices.

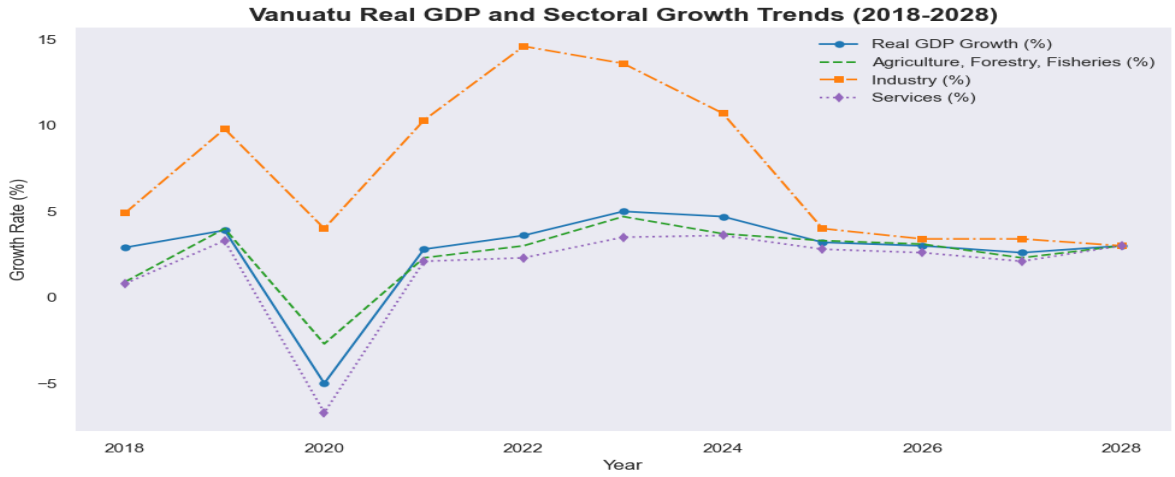
In 2021, the preliminary GDP estimates recorded a decline of -1.6%. This downturn occurred despite a slight improvement in domestic economic activity, primarily driven by a weakened tourism and travel sector. Positive contributions to the economy came from remittance inflows and government spending related to economic stimulus packages. Additionally, the rise in commodity prices and new market opportunities for exports, particularly copra, kava, root crops, beef, and cocoa, provided a boost to primary production. Figure 2 shows year-on-year growth rates measured by percentage change in constant 2006 prices.

Figure 2: Source: Vanuatu Bureau of Statistics [VBoS], 2023



The Figure 3 shows the percentage changes in Vanuatu's Real GDP Growth and key sectors – Agriculture, Forestry, Fisheries, Industry, and Services—between 2018 and projections through 2050. Real GDP growth experienced a sharp decline in 2020 (-5%) due to global disruptions, but a steady recovery is projected, with growth stabilizing at around 3% annually from 2028 onwards.

Figure 3 Source: rates for 2018 to 2027 from Government of Vanuatu Department of Finance and Treasury. Rates 2028–2050 were selected for LEDS modelling.



The Agriculture, Forestry, and Fisheries sector similarly saw a downturn in 2020 (-2.7%), followed by consistent recovery and anticipated annual growth of 3% post-2028. The industry sector demonstrated significant volatility, with a peak growth rate of 14.6% in 2022, largely due to infrastructure and industrial development, but it is expected to stabilize at 3% from 2028 onward. The Services sector faced a notable drop in 2020 (-6.7%), but recovery has been gradual, with a projected stable 3% growth after 2028. These trends reflect Vanuatu's economic resilience and its ongoing efforts to stabilize key sectors in the face of global economic challenges.

The industrial sector experienced a decline in 2021 after four consecutive years of strong growth. This decline was largely attributed to setbacks in construction activities linked to post-Tropical Cyclone Harold reconstruction efforts and other major infrastructure projects that were delayed due to COVID-19 restrictions. Construction recorded a decrease of 6%, while electricity and water services registered modest growth of 0.2%. The manufacturing sector continued to expand, achieving an 8% growth, driven primarily by agricultural products geared towards export.

In the service sector, there was a slight recovery, with a positive growth of 0.4% in 2021, totalling totaling a value added of VT 42,970 million in constant 2006 prices. The main contributors to this growth included Retail Trade (5.2%), Professional, Scientific, and Technical Services (4.8%), Real Estate (2.9%), and Information and Communication (0.8%). However, this positive performance was offset by declines in Accommodation and Food Services (-16%), Transport (-15%), and other Service Areas and retail trade (5.2%), professional, scientific, and technical services (4.8%), real estate (2.9%), and information and communication (0.8%). However, this positive performance was offset by declines in accommodation and food services (-16%), transport (-15%), and other service areas.

The GDP at current prices for 2021 was estimated at VT 107,522 million, reflecting nominal growth of 2.5%. The GDP Implicit Price Deflator (IPD), which measures overall price changes in the economy, increased by 4.1% in 2021, higher than the 2.8% inflation rate recorded in 2020. The GDP per capita stood at VT 216,275 in real terms, marking a decrease of -3.9% compared to 2020.

Population and Demographics

An important factor in a country's development is the size and temporal evolution of its population. From a gender perspective, understanding the relationship between gender and population demographics is crucial for formulating effective policies aimed at achieving favorable development outcomes. For instance, research has shown that robust governance is essential in reducing poverty, and timely policy implementation is more likely to mitigate poverty. Moreover, the inclusion of women in the labor market and an efficient governance system contribute to enhanced well-being among the poor.

In many modern developed countries, decreasing gender inequality often leads to increased opportunities for women to fulfill family and professional obligations, resulting in a higher birth rate. Conversely, in developing countries, the trend is generally reversed; increasing gender inequality tends to correlate with higher birth rates. Understanding population demographics and dynamics from a gender perspective is essential for defining strategies to achieve national development goals and the Sustainable Development Goals (SDGs). This understanding assists in forming effective policies addressing issues related to fertility, mortality, internal and international migration, and balanced regional development.

The results of the 2020 census show that Vanuatu had a total population of 300,019 inhabitants, comprising 148,422 females (49.5% of the population) and 151,597 males (50.5%). These percentages are consistent across both urban and rural areas. In urban regions, males constituted 50.3% of the population, while females accounted for 49.7%. In rural areas, males made up 50.6%, and females represented 49.4% of the population.

Vanuatu has a relatively young population, with a median age of 20 years—meaning half the population is older than 20, and half is younger. Specifically, the median age for urban areas was 23 years, compared to 19 years in rural areas. The disparity in median age between urban and rural areas is primarily due to different age structures in these locations. Notably, over 77% of the Vanuatu population resides in rural areas, where the median age is often lower.

Figure 4: Source: Vanuatu National Statistics Office (2020). *National Population and Housing Census, Basic Tables Report, Volume 1*.2020 National Population and Housing Census, Basic Tables Report, Volume .

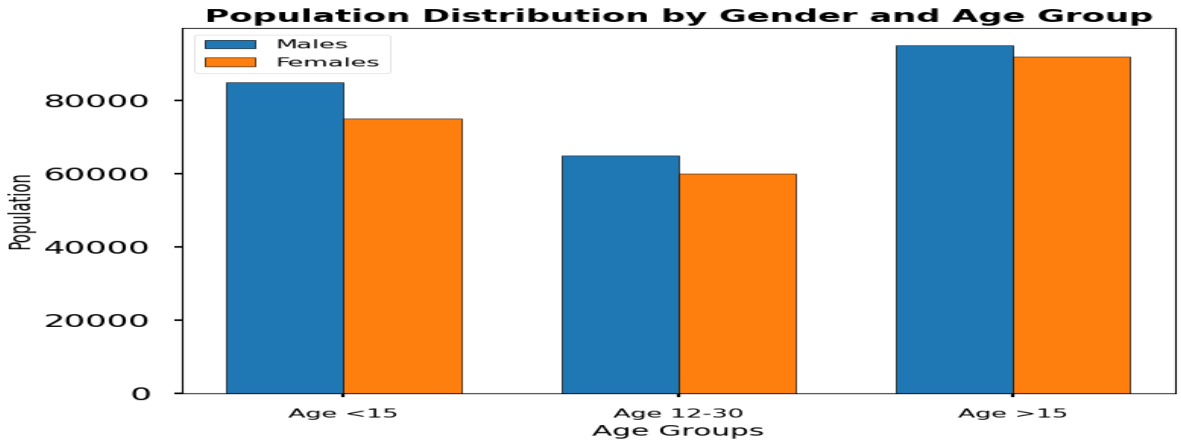


Figure 4 reveals a marked difference between males and females in the youngest age group (under 15 years), where there are more males than females. In contrast, for the age group over 15 years, significantly more females than males are observed. Within the 12–30 age group, the male and female populations are nearly balanced, highlighting the shifts in gender ratios as age increases.

This demographic profile underscores the importance of addressing gender-related issues in policy-making and national development strategies, as understanding population dynamics can help shape initiatives that foster equitable growth and development across all segments of society.

Figure 5 Sources: national population UN Population Division medium variant scenario, regional distribution calculated using 2020 Census proportions.

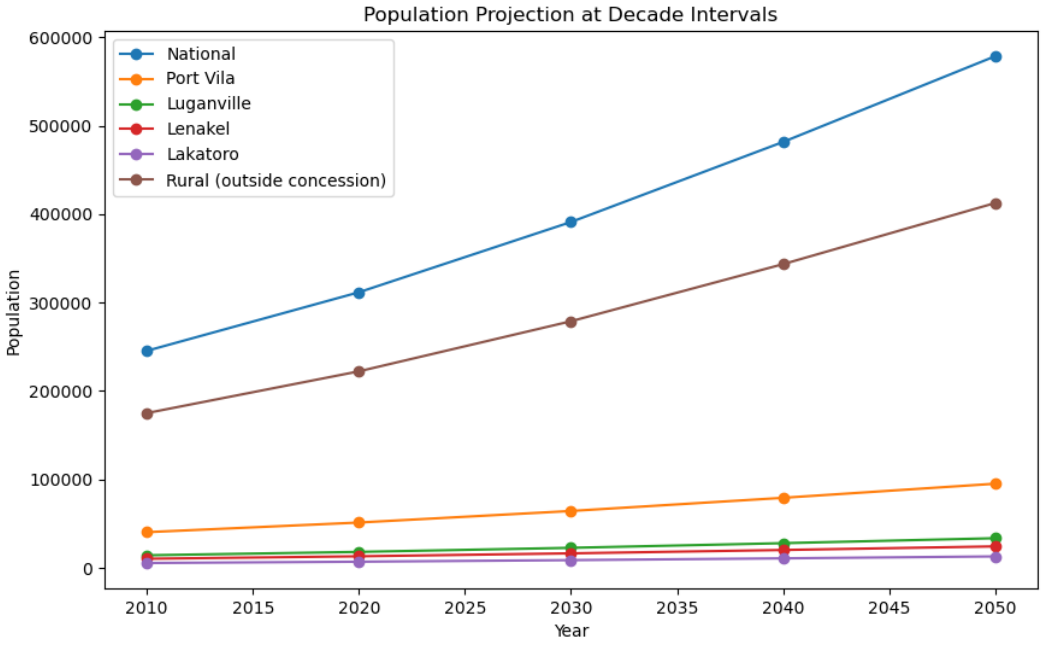


Figure 5 shows the discrepancy between the current national population estimates and those for 2020. The 2020 Census reported a population of 301,695, which is about 3%, or 10,000 people, lower than the United Nations Population Division's estimate of 311,685. For the purpose of the LEDS, the United Nations estimate was used due to its consistent projections for both the present and future. The Government of Vanuatu does not produce its own population forecasts.

Infrastructure

Vanuatu's transport sector is increasingly targeted for emissions reduction, with key strategies outlined in the National Energy Road Map (NERM) and Vanuatu's Enhanced Nationally Determined Contribution (NDC) (2020). Although these actions aim to lower emissions, the long-term challenge remains the rising demand for transport. While The NERM and NDC actions are expected to reduce emissions by 34,000 tCO_2 equivalent (CO2-e) annually, transport demand is projected to increase emissions by an additional 55,000 tonnes CO_2e per

year, creating a net rise in emissions. Addressing these future demands requires further steps, particularly in electric vehicle adoption and renewable energy integration, to meet the Low Emissions Development Strategy (LEDS) vision by 2050.

Road Transport

Road transport is a significant focus in Vanuatu's emissions reduction strategy. Electrification is seen as essential, with the government aiming to pilot electric mobility within government fleets and public buses by 2030. As transport demand is expected to double between 2017 and 2050, the share of electric transport in Vanuatu must reach 50% by 2050 to stabilize emissions at current levels. However, achieving this will require the development of policies and infrastructure to support electric vehicle use. Additionally, Vanuatu will need a skilled labor market, particularly in areas like electrical engineering, automotive servicing, and software development, to maintain the electric vehicle fleet envisioned for the future.

Maritime Transport

Maritime transport, like land transport, is part of Vanuatu’s broader electrification plan. The LEDS pathway proposes that 50% of maritime transport should be electrified by 2050. Achieving this will require infrastructure investments, such as constructing new wharves and docks, and establishing charging stations for electric vessels. The successful implementation of these goals depends on coordinated planning and investment from both the public and private sectors.

Policy Development

Vanuatu's transport sector has a significant opportunity to establish a comprehensive framework focused on low-cost, low-emission, equitable, and resilient services. The absence of a national transport policy allows for strategic planning, with the National Sustainable Development Plan (NSDP) emphasizing equitable transport as a key objective. Future policies should draw from the results of proposed e-mobility pilot projects, which will inform the creation of essential infrastructure like charging stations and necessitate updates to government regulations.

To facilitate this transition, robust institutional and financial frameworks are essential. Investment from public, private, and donor sources will be crucial to meet the infrastructure needs of a growing population. While the Public Works Department (PWD) and the Ministry of Infrastructure and Planning Utilities (MIPU) have laid the groundwork, updated institutional arrangements are necessary for effectively planning and funding the development of roads, bus stops, and charging stations. This infrastructure will not only promote economic growth but also enhance social equity by improving regional access to services and opportunities.

Waste Management

Vanuatu's per capita solid waste generation increased from 0.43 kg/day in 2011 to 1.5 kg/day in 2017. While urban centers like Port Vila and Luganville have controlled disposal sites, many areas still rely on open backyard dumpsites, disposal at sea, or burning. Managing landfills, particularly in Port Vila, remains a challenge, with rural waste posing less risk due to its

scattered nature. To address the issue, Vanuatu is collaborating with Japan International Cooperation Agency (JICA) to improve solid waste management.

Efforts to promote recycling and reuse include initiatives for materials like glass, metals, and PET bottles. In 2018, the country banned single-use non-biodegradable plastics, including shopping bags and polystyrene containers, and recently expanded this ban to include plastic cutlery and grocery packaging. However, liquid waste is largely managed through individual onsite systems, as there is no effective reticulated treatment system in place.

Energy

Vanuatu's energy sector aims to reduce fossil fuel dependency, promote renewable energy, and enhance energy security through efficiency measures. The National Energy Road Map (2016–2030) targets 100% electricity generation from renewable sources and universal household access to electricity by 2030.

Currently, biomass and imported petroleum are Vanuatu's main energy sources. Biomass is mostly used for household needs like cooking, while petroleum supports key sectors such as electricity, transportation, tourism, and agriculture. Petroleum consumption has grown at an annual rate of 6%. Electricity generation relies heavily on diesel (71%), with renewable sources like hydro, solar, wind, and biofuel contributing 29%. Expanding renewable energy use and improving infrastructure remain critical for achieving the country’s energy goals.

Under the business-as-usual (BAU) scenario, energy efficiencies and elasticities for residential, industry, services, and transport remain constant. Energy demand is projected to rise from 3.4 Petajoules (PJ) in 2020 to 6.8 PJ by 2050.

Tourism

Tourism plays a crucial role in Vanuatu's economy, and the country is pursuing a “greener” approach through its National Sustainable Tourism Policy (VSTP), which aims to balance economic viability, social acceptability, and environmental responsibility while enhancing the resilience of Vanuatu's cultural, social, and ecological systems in the face of climate change challenges (National Sustainable Tourism Policy). The sector is gradually recovering from setbacks, particularly the impact of Tropical Cyclone Pam in 2015 (National Statistics Office, 2019).

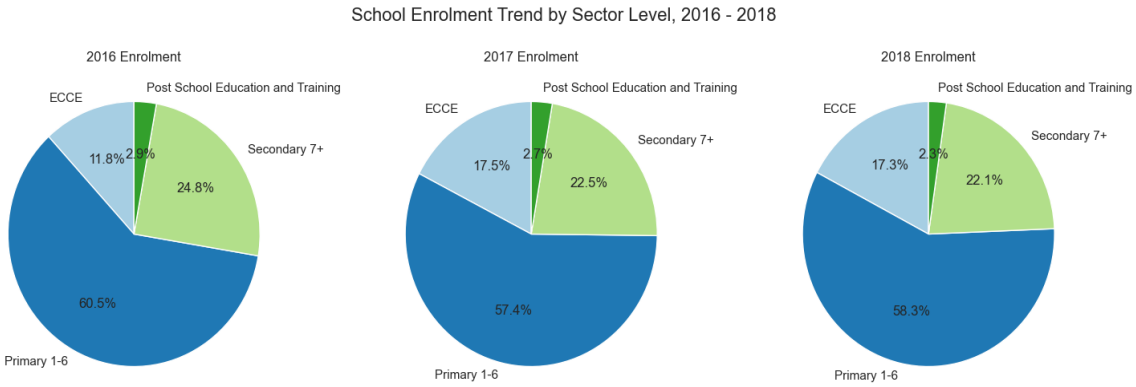
In the September quarter of 2019, international visitor arrivals totaled 63,407, marking a 16% decline from the same period in 2018, largely attributed to reduced sea arrivals (National Statistics Office, 2019). Conversely, there was a 19% increase compared to the previous quarter in 2018. Air travel constituted 58% of international visitors, totaling 36,587, representing a 9% increase from the same quarter in 2018 and a significant 29% increase over June 2019 (National Statistics Office, 2019).

Education

Vanuatu has a bilingual education system where both English and French are taught at all levels, from Early Childhood Education (ECCE) to Secondary schools. In 2018, ECCE

enrollment increased by 4.9%, primary by 7.7%, and secondary by 3.9% compared to 2017. The number of teachers in ECCE and primary schools also rose. Data gaps in the Vanuatu Education Management Information System (VEMIS) were noted, with efforts underway to fully record teacher qualifications. School grants have been a key factor in boosting enrollment, as parents no longer pay tuition fees since 2010.

Figure 5 Source: Open VEMIS, 2018



Biennial Transparency Report and National Communications Institutional Arrangements

The first Biennial Transparency Report (BTR1) of the Republic of Vanuatu is being implemented by the Ministry of Climate Change (MoCC) in collaboration with the United Nations Development Programme (UNDP). The UNDP is aiding the MoCC in establishing a national system for regular greenhouse gas (GHG) inventories, developing mitigation assessments, and conducting vulnerability assessments as part of the BTR1 initiative.

Key steps in preparing the BTR1 and national GHG inventory for 2007-2015 include:

- Project Organization Structuring
- Formation of Thematic Working Groups (TWGs)
- Stakeholder Consultation Process
- Training and Capacity Building Program
- Data Collection, Identification of Data Gaps, and Uncertainty Assessment
- Documents/Data Review for Quality Assurance
- Preparation and Review of the GHG Inventory Report

The BTR1 is managed by a Project Board responsible for consensus-based management decisions and guiding the Project Manager. This board comprises the Directors-General of key ministries, a National Advisory Board (NAB) representative, the Director-General of the MoCC as Executive, and the Country Director from UNDP as Senior Supplier. The Fiji UNDP Country Office provides project assurance, with additional quality assurance from the UNDP Regional Technical Advisor as necessary.

The project implementation team includes the Department of Energy (DoE), the Climate Change Project Management Unit (PMU), the BTR1 project coordinator, and consultants. The

MoCC coordinates consultations with relevant government departments, the private sector, and NGOs. Additionally, the DoE is responsible for central coordination in the energy and climate change mitigation sector, providing technical and policy oversight.

Thematic Working Groups (TWGs)

The Thematic Working Groups (TWGs) were established to support the preparation of various components of the national communication, including the National Greenhouse Inventory, Mitigation Analysis, Vulnerability and Adaptation, Research and Systematic Observation, and Education, Training, Public Awareness, Information, Networking, and Capacity-Building.

The following table presents the key agencies within the TWGs:

Table 1.1: Vanuatu's Thematic Working Groups

TWGs	Members
TWG - National Circumstances	Department of Strategic Policy Planning and Aid Coordination (DESPAC)
	Department of Environmental Protection and Conservation (DEPC)
	Department of Finance and. Treasury (DFT)
	Department of Foreign Affairs and External Trade (DFET)
	National Advisory Board on Climate Change (NAB Sec)
	Department of Women Affairs (DWA)
	Department of Agriculture (DARD)
	Fisheries Department
	Department of Energy (DOE)
TWG GHG- Green House Gas (GHGI)	Department of Energy (DOE)
	Department of Forests (DoF)
	Department of Agriculture (DARD)
	Livestock Department
	Port Vila Municipality Council (PVMC)
	Utilities Regulatory Authority (URA)
	Vanuatu National Statistics Office (NSO)
	Department of Environmental Protection and Conservation (DEPC)
	Department of Biosecurity
TWG - Vulnerability Assessment and Adaptation (V&A)	Department of Environmental Protection and Conservation (DEPC)
	National Disaster Management Office (NDMO)
	Vanuatu Meteorology & Geohazards Division (VMGD)
	Department of Agriculture (DARD)
	Department of Geology, Mines &Water Resources (DGMWR)
	Department of Forests (DoF)
	Fisheries Department
	Ministry of Health (MoH)
	Public Works Department (PWD)
	Department of Local Authorities (DLA)
	Lands Survey
	Vanuatu Meteorology & Geohazards Division (VMGD)
TWG - Mitigation	Vanuatu Meteorology & Geohazards Division (VMGD)
	Ministry of Agriculture
	Ministry of Climate Change (MoCC)
	Ministry of Education and Training(MoET)

	National Disaster Management Office (NDMO)
	Vanuatu Meteorology & Geohazards Division (VMGD)
	Department of Environmental Protection and Conservation (DEPC)
	Department of Forests (DoF)
	Lands Survey
TWG - Research & Systematic Observation	Vanuatu Meteorology & Geohazards Division (VMGD)
	Vanuatu Meteorology & Geohazards Division (VMGD)
	National Disaster Management Office (NDMO)
	Vanuatu Meteorology & Geohazards Division (VMGD)
	Department of Agriculture (DARD)
	Fisheries Department
	Department of Geology, Mines &Water Resources (DGMWR)
	Ministry of Health (MoH)

Department of Climate Change

Department of Climate Change (DOCC) in Vanuatu, formed under the Meteorology, Geological Hazards, and Climate Change Act No. 25 of 2016, is tasked with coordinating and implementing Adaptation, Disaster Risk Management, and Mitigation efforts against climate change impacts nationwide. It is the fifth department under the Ministry of Climate Change and Natural Disasters (MOCC). As the focal point for resilient development in Vanuatu, the DOCC aims to lead climate change innovation across the country and the Pacific, support the National Advisory Board on Climate Change and Disaster Risk Reduction (NAB), improve sustainability by transitioning highly skilled contracted staff into permanent government roles, and maintain momentum on existing projects. Additionally, it seeks to advance initiatives in Climate Change and Disaster Risk Reduction, ensure compliance with international conventions, mainstream climate change policies across the government per the National Sustainable Development Plan (NSDP), operationalize the Climate Change and Disaster Risk Reduction Policy, and secure new projects and funding for climate and disaster risk management

Climate Change Acts, Plans, and National Targets

- **Environmental Management and Conservation Act No. 12 (2011 Amendment)**: Regulates biodiversity and environmental impact assessments, includes climate change in decision-making, establishes a climate change database, and outlines obligations under the UNFCCC.
- **Forestry Rights Registration and Timber Harvest Guarantee Act No. 28 (2000)**: Regulates forestry rights, including provisions for carbon sequestration rights, with amendments in 2012 for sandalwood regulations.
- **Nationally Determined Contributions (NDC)**: Aims for near 100% renewable energy in the electricity sector by 2030, sets a 15% emission reduction target across all sectors (excluding agriculture and forestry), and seeks a reduction of 72Gg in energy sector emissions by 2030.
- **National Adaptation Programme of Action (NAPA) 2007**: Identifies urgent adaptation activities in agriculture, water management, sustainable tourism, marine resource management, and forestry.

- **National Adaptation Plan (NAP)**: A UNEP-developed proposal to enhance adaptation planning and governance, with a grant funding target of USD 3 million.
- **Vanuatu National Energy Roadmap (2013)**: Outlines a long-term plan for secure, affordable, and clean energy services in the energy sector.
- **Vanuatu Strategic Tourism Action Plan 2014-2018**: Addresses climate change in tourism development, proposing a Sustainable Tourism Development Policy that integrates environmental management.

Policies and Regulatory Frameworks

- **Vanuatu Climate Change and Disaster Risk Reduction Policy (2016-2030)**: This flagship policy aims for "resilient development" to enhance capacities to absorb and recover from climate-related shocks. It emphasizes governance, finance, knowledge, adaptation, low-carbon development, and response strategies.
- **Vanuatu Framework for Climate Services (VFCS) (2016)**: Developed by the Vanuatu Meteorology and Geo-Hazards Department, VFCS aims to provide world-class climate services to help manage climate variability and change. It identifies information gaps and proposes activities for improvement.
- **Vanuatu Forest Policy (2013-2023)**: This policy integrates climate change adaptation into forestry planning, promoting climate-resilient species and agro-forestry systems while addressing food security and water management.
- **REDD+ Initiative**: Supported by the SPC-GIZ Regional REDD+ Project, this initiative focuses on forest inventory protocols and climate adaptation assessments to enhance forest management.
- **National Water Strategy (2008-2018)**: It promotes sustainable access to safe water while recognizing climate impacts on potable water availability and its uses.
- **National Fisheries Sector Policy (2016-2031)**: This policy includes climate change as a priority, aiming to assess environmental impacts on fisheries and implement disaster preparedness strategies.
- **National Ocean Policy (2016)**: Acknowledges the importance of the ocean to Vanuatu's economy and includes actions for climate change mitigation and disaster risk reduction.
- **National Biodiversity Strategy and Action Plan (2018)**: Focuses on community conservation areas to enhance biodiversity and sustainability through protected area management.
- **Agriculture Sector Policy (2015-2030)**: Aims for sustainable agricultural resource management while mainstreaming climate change adaptation strategies.
- **National Livestock Policy (2015-2030)**: This policy highlights the need for climate knowledge in livestock management to enhance socio-economic development.
- **Gudfala Kakae Policy (2017-2030)**: Promotes access to nutritious local food while enhancing agricultural resilience through sustainable practices.
- **National Environment Policy and Implementation Plan (NEPIP) (2016-2030)**: An overarching policy for environmental management that supports climate resilience.
- **National Waste Management and Pollution Control Strategy (2016-2020)**: Aims for environmentally sustainable waste management practices.
- **National Gender Equality Strategy (2015-2019)**: Addresses women's vulnerability to climate change, emphasizing equal rights and opportunities.

- **National Biosecurity Policy**: Focuses on protecting Vanuatu's biodiversity and ecosystems in light of climate challenges.

Conventions

The table below outlines Vanuatu's involvement in international environmental conventions and treaties, highlighting the dates of signature and ratification/accension. These agreements reflect the country's ongoing commitment to addressing global environmental issues such as climate change, biodiversity conservation, and sustainable development.

Table 1.2: Vanuatu's Participation in International Environmental Conventions

Treaty	Signature Date	Ratification/ Status
Basel Convention	16 Oct 2018	Accession
Convention on Biological Diversity	9 Jun 1992	25 Mar 1993 (Ratification)
Convention on International Trade in Endangered Species of Wild Fauna and Flora	17 Jun 1989	15 Oct 1989 (Accession)
Kyoto Protocol	-	17 Jul 2001 (Accession)
Minamata Convention on Mercury	16 Oct 2018	Accession
Montreal Protocol	-	21 Nov 1994 (Accession)
Nagoya Protocol	18 Nov 2011	1 Jul 2014 (Ratification)
Paris Agreement	22 Apr 2016	21 Sep 2016 (Ratification)
Rotterdam Convention	16 Oct 2018	Accession
Stockholm Convention	21 May 2002	16 Sep 2005 (Ratification)
The Kigali Amendment (2016)	20 Apr 2018	Signatory
United Nations Convention to Combat Desertification	28 Sep 1995	10 Aug 1999 (Ratification)
United Nations Framework Convention on Climate Change	9 Jun 1992	25 Mar 1993 (Ratification)
United Nations Convention on the Law of the Sea	10 Dec 1982	10 Aug 1999 (Ratification)

International Commission for the Conservation of Atlantic Tunas	-	25 Oct 2002 (Accession)
Vienna Convention	-	21 Nov 1994 (Accession)

Stakeholder Participation

Stakeholder consultations involved the government, public and private sectors, NGOs, development partners, and public groups. The first phase introduced the goals of the BTR1 and National GHG Inventory project, focusing on data collection, climate change mitigation, adaptation, and vulnerability management. In the second phase, stakeholders reviewed the National GHG Inventory for 2007-2015, including data, standards, and gaps. The goal was to validate the inventory's assumptions and gather input from a broad range of participants.

Gender Analysis

Vanuatu remains a predominantly patriarchal society, with women traditionally confined to domestic roles. Women's participation in politics and senior decision-making remains low due to entrenched social and cultural norms favoring male leadership. However, progress has been made, such as an increase in women in senior public sector roles (from 0.3% in 2010 to 3.4% in 2016) and the introduction of reserved seats for women in municipal councils, resulting in five women being elected in both Port Vila and Luganville in 2014.

Positive changes include a narrowing gender gap in literacy, a decline in child mortality, and increased female participation in waged employment. The Family Protection Act (FPA) of 2008 also provides legal protection for victims of violence. Several government ministries have integrated gender strategies into their policies.

Challenges persist, as more women than men are involved in the subsistence economy, and female-headed households face additional burdens. A study by Care International (2015) in Tafea Province highlighted difficulties for women in accessing labor for gardening, while water collection was more equitably shared. Concerns about cyclone impacts on children's education and limited livelihood options were also prevalent.

II. National Greenhouse Gas Inventory

Chapter 1: National circumstances, institutional arrangements and cross-cutting information

1.1 Background information on GHG inventories and climate change

1.1.1 Inventory reporting

Vanuatu is a party to both the United Nations Framework Convention on Climate Change and the Paris Agreement (PA) is committed to develop, publish, and regularly update national greenhouse gas inventories.

This inventory report and associated Common Reporting Tables (CRTs) have been prepared in accordance with chapter II of the annex to the decision 18/CMA.1 Modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement[1] (known as the MPG) and decision 5/CMA.3 Guidance for operationalizing the modalities, procedures and guidelines for the enhanced transparency framework referred to in Article 13 of the Paris Agreement[2]. The report provides estimates of Vanuatu's net greenhouse gas emissions for the year reporting year 2023 and the time series 1994-2023.

Consistent with the MPG and decision 5/CMA.3, emissions estimates provided in this report have been compiled in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006 Guidelines).

1.1.2 Gases

In this report, a detailed description of the anthropogenic Greenhouse Gases (GHG) inventory of the emissions of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) and hydrofluorocarbons (HFCs) (It is to be noted that Vanuatu has negligible or no emission of perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6), and nitrogen trifluoride (NF_3) hence not applicable), by sources and their removal by sinks has been presented for reporting year 2023. As UNFCCC Reporting Guidelines also encourage Parties to provide information on the following indirect GHGs: Oxides of Nitrogen (NOx), Carbon Monoxide (CO) and Sulphur

[1] FCCC/PA/CMA/2021/10/Add.2, chapter II, https://unfccc.int/sites/default/files/resource/CMA2021_L10a2E.pdf
[2] FCCC/PA/CMA/2021/10/Add.2, https://unfccc.int/sites/default/files/resource/CMA2021_L10a2E.pdf

dioxide (SO_2), and Non-Methane Volatile Organic Compounds (NMVOC), emissions from these indirect gas from the Energy sector in this inventory.

This Report presents emissions for each of the major greenhouse gases as carbon dioxide equivalents (CO_2e) using the 100-year global warming potentials (GWPs) contained in the 2014 IPCC Fifth Assessment Report (IPCC 2014)[3].

1.1.3 Sectors

The sectors covered include Energy, Agriculture, Forestry and Land Use (AFOLU), and Waste (Vanuatu has no emissions from Industrial Processes and Product Use (IPPU) sector).

The reference approach has also been used to estimate equivalent CO_2 emissions from the energy sector for the year 2023. GHG emissions from international bunker (international Aviation and international water-borne navigation) have also been estimated and reported as memo items in the inventory; however, they have not been included in the Vanuatu's total national GHG emissions. The Tier-1 methodological tier and IPCC default emission factors employed for GHG estimation has been used by Vanuatu for the previous inventory submissions (under first, second and third national communications and First Biennial Update Report) this inventory covering the inventory years 2018-2023.

1.1.4 Structure of the National Inventory Report

The structure of this Report has been organised to conform to the requirements of Annex V to decision 5/CMA.3 on the outline of the national inventory document, pursuant to the modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the Paris Agreement.

This report provides information background on the national system and the inventory preparation processes. Further, it also provides also provides estimates of Vanuatu's total net emissions and identifies trends in emissions for each of the sectors and for the main greenhouse gases, methodologies used, the quality assurance/quality control (QA/QC) measures applied, the results of the key category analysis, and approach-I quantification of the uncertainties associated with the estimates.

1.2 A description of national circumstances and institutional arrangements

1.2.1 National entity or national focal point

The Ministry of Climate Change Adaptation (MoCC), Meteorology & Geo-Hazards, Energy, Environment and National Disaster Management is the nodal agency as part of the Government's efforts to streamline Vanuatu's climate change natural disaster responses and sustainable development of the environment. The Department of Climate Change (DoCC) has been established as part of the Government of Vanuatu's ongoing efforts for enhancing

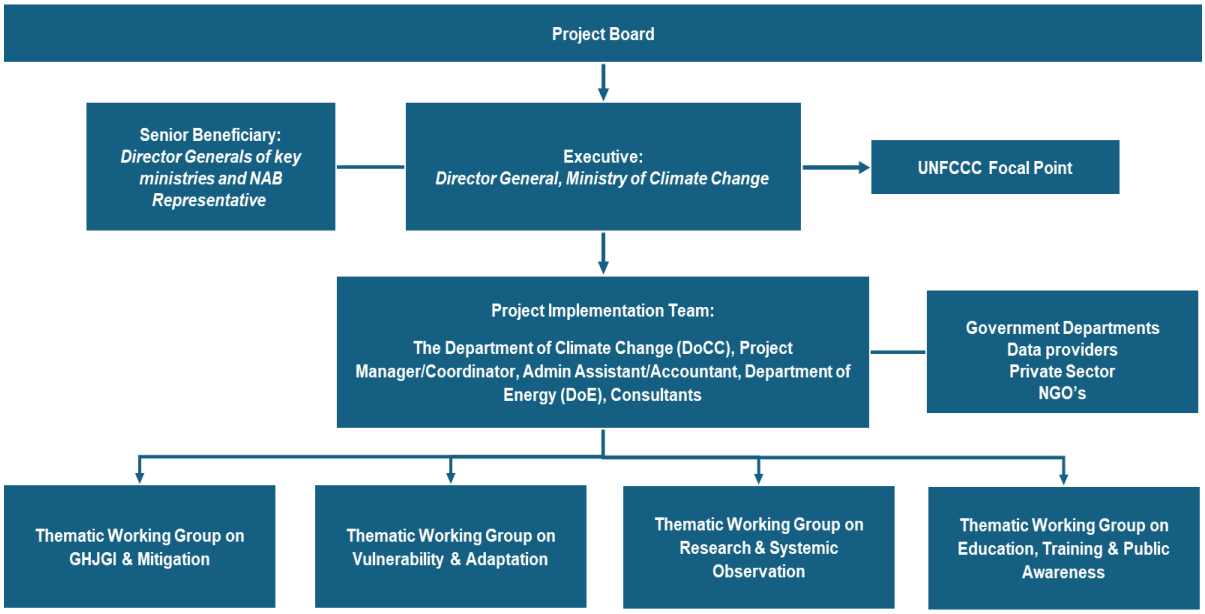
[3] GWPs used are, 1 for CO_2, 28 for CH_4, 265 for N_2O, the full list of GWPs can be found in Table 8.A.1 of Chapter 8: Anthropogenic and Natural Radiative Forcing of the 2014 IPCC Fifth Assessment Report (AR5). GWPs are not available for the indirect greenhouse gases and in accordance with the Paris Agreement reporting guidelines, are reported but are not included in the inventory total.

national resilience in the face of global climate change impacts. The department has been formed and mandated as per the 'Meteorology, Geological Hazards and Climate Change Act No. 25 of 2016 (Climate Change Act)', to ensure that high quality services are provided in relation to climate change in Vanuatu.

1.2.2 Inventory preparation process

The preparation of Vanuatu's National Greenhouse Gas Inventory was led by the Ministry of Climate Change Adaptation, Meteorology, Geo-Hazards, Environment, Energy and Disaster Management (MoCC) through the Department of Climate Change (DoCC) with support from the various Ministries and Government Departments, Public sector undertakings, Private sector development partners and NGOs. Many of these institutions / experts have been part of the inventory preparation exercise since Vanuatu's Initial National Communication, hence well aware about the national circumstances, capacities and limitations.

Figure 1.1: Institutional Arrangement and Organization Structure for National GHG Inventory



The National GHG Inventory of Vanuatu, submitted under the previous national communications (SNC, TNC and FBUR) and the First Biennial Transparency Report for the period 2018–2023 (as part of Vanuatu's First Biennial Transparency Report to the United Nations Framework Convention on Climate Change), is managed by the Project Board. The board is primarily responsible for making management decisions by consensus when guidance is required by the Project Manager, including recommendations for UNDP (the Implementing Partner) approval of project plans and revisions.

The Project Board is comprised of:

- Director General (DG) of key stakeholder ministries
- National Advisory Board (NAB) on Climate Change & Disaster Risk reduction representative as Senior Beneficiaries
- Director-General Ministry of Climate Change as the Executive.

The Department Climate Change (DoCC), the Department of Energy (DoE), project coordinator and consultants formed the project implementation team. The Ministry of Climate Change undertook tasks of consultation with other relevant government departments, the private sector and NGOs. The thematic working group (TWG) for national GHG inventory included representatives from Department of Energy (DOE), Department of Forests (DoF), Department of Agriculture (DARD), Livestock Department, Port Vila Municipality Council (PVMC), Utilities Regulatory Authority (URA), Vanuatu National Statistics Office (NSO), Department of Environmental Protection and Conservation (DEPC), Biosecurity, private sector representatives from Union Électrique du Vanuatu (UNELCO) and Vanuatu Utilities & Infrastructure (VUI), etc.

Training and Capacity Building

The Training and Capacity Building programme was designed and delivered to TWGs and key stakeholders. A technical training and hand-holding workshop on development of GHG inventory was organized for the TWGs and other relevant key stakeholders in Vanuatu. The overall objective was to empower the stakeholders in Vanuatu to achieve the necessary level of expertise to develop national GHG inventory through data collection, analysis, monitoring and reporting guidelines and procedures as required by UNFCCC. The stakeholders were also updated on IPCC 2006 Guidelines and Best Practices to develop the national GHG Inventory and GHG inventory software developed under the Integrated Monitoring, Reporting and Verification (MRV) Tool for Vanuatu.

Stakeholder Consultation

The focused stakeholder consultation was carried out with in the government and government departments, public and private sectors, local and international development partners, NGOs and public groups. The stakeholder consultation also involved presentation of the results i.e. National GHG Inventory of Vanuatu for the year 2018-2023, data, standards and assumptions applied for Vanuatu's National GHG inventory, data gaps and uncertainties etc.

The objective of the stakeholder consultation was also to validate the assumptions and standards used for GHG inventory and seeks the inputs from wide stakeholders. An important aspect of the stakeholder consultation was to update on the data gaps, uncertainties etc. and issues and activities to be considered to improve the quality, completeness and transparency of GHG inventory and updates on inventory improvement plan.

1.2.3. Archiving of information

The information regarding the data and results of the inventory carried out under the previous national communications and for the current inventory for the years 2018-2023 is kept, both in written and electronic format. The data and documents archives are maintained at the Department of Climate Change.

1.2.4. Processes for official consideration and approval of inventory

The NIR reports are subjected to formal approval from the NAB and endorsement by the Cabinet. Prior to the final approval, the NIR undergoes various review stages internally through stakeholder consultations. The report is submitted together with a cabinet paper to the cabinet for deliberation. The cabinet approves with a cabinet conclusion that entails specific editions

to be made before submitting. The UNFCCC National focal point is responsible for submitting the report to the Secretariat.

1.3. Brief general description of methodologies (including tiers used) and data sources used

1.3.1 Estimation methods

The IPCC inventory methodology is divided into various levels of tiers, with generally higher tiers being more detailed methodology and more accurate while the tier 1 level represents the minimum, or default methodology. The national GHG inventory of Vanuatu for the period 2018-2023 is estimated using the tier 1 methodology and using Default emission factors provided by the 2006 IPCC Guidelines for the direct GHGs emissions. A consistent approach has been applied throughout the entire time series and there are no recalculations due to methodological changes and refinements.

Furthermore, to ensure completeness, the national GHG inventory of Vanuatu uses notation keys where numerical data are not available. These notation keys include:

- “NO” (not occurring): Used for categories or processes, including recovery, under a particular source or sink category that do not occur within a Party.
- “NE” (not estimated): Used for activity data and/or emissions by sources and removals by sinks of GHGs that have not been estimated but for which a corresponding activity may occur within a Party.
- “NA” (not applicable): Used for activities under a given source/sink category that do occur within the Party but do not result in emissions or removals of a specific gas.
- “IE” (included elsewhere): Used for emissions by sources and removals by sinks of GHGs estimated but included elsewhere in the inventory instead of under the expected source/sink category.
- “C” (confidential): Used for emissions by sources and removals by sinks of GHGs where the reporting would involve the disclosure of confidential information.

Table 1.2 provides an overview of the used IPCC inventory methodology and corresponding EF of Vanuatu’s national GHG inventory in the inventory period 2018-2023.

Table 1.2. Methodological tiers used the national GHG inventory of Vanuatu in the inventory period 2018-2023

GREENHOUSE GAS SOURCE AND SINK	CO_2		CH_4		N_2O		HFCs		PFCs		Unspecified mix of HFCs and PFCs		SF_6		NF_3	
CATEGORIES	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor	Method applied	Emission factor
1. Energy	T1	D	T1	D	T1	D										
1.A. Fuel combustion	T1	D	T1	D	T1	D										
1.A.1. Energy industries	T1	D	T1	D	T1	D										
1.A.2. Manufacturing industries and construction	T1	D	T1	D	T1	D										
1.A.3. Transport	T1	D	T1	D	T1	D										
1.A.4. Other sectors	T1	D	T1	D	T1	D										
1.A.5. Other	NO	NO	NO	NO	NO	NO										
1.B. Fugitive emissions from fuels	NO	NO	NO	NO	NO	NO										
1.B.1. Solid fuels	NO	NO	NO	NO	NO	NO										
1.B.2. Oil and natural gas and other emissions from energy production	NO	NO	NO	NO	NO	NO										
1.C. CO2 transport and storage	NO	NO														
2. Industrial processes	NO	NO	NO	NO	NO	NO	T1	D	NE,NO	NE,NO	NE,NO	NE,NO	NO	NO	NO	NO
2.A. Mineral industry	NO	NO	NO	NO	NO	NO										
2.B. Chemical industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.C. Metal industry	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.D. Non-energy products from fuels and solvent use	T1	D	NO	NO	NO	NO										
2.E. Electronic Industry					NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.F. Product uses as ODS substitutes							NE	NE	NE	NE	NE	NE	NO	NO	NO	NO
2.G. Other product manufacture and use	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
2.H. Other	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
3. Agriculture	NO	NO	T1	D	T1	D										
3.A. Enteric fermentation			T1	D												

3.B. Manure management			T1	D	T1	D										
3.C. Rice cultivation			NO	NO												
3.D. Agricultural soils			NA	NA	NE	NE										
3.E. Prescribed burning of savannahs			NO	NO	NO	NA										
3.F. Field burning of agricultural residues			NO	NO	NO	NO										
3.G. Liming	NO	NO														
3.H. Urea application	T1	D														
3.I. Other carbon-containing fertilizers	NO	NO														
3.J. Other	NO	NO	NO	NO	NO	NO										
4. Land use, land-use change and forestry	T1	D	NE	NE	NE	NE										
4.A. Forest land	T1	D	NE	NE	NE	NE										
4.B. Cropland	NE	NE	NE	NE	NE	NE										
4.C. Grassland	NE	NE	NE	NE	NE	NE										
4.D. Wetlands	NE	NE	NE	NE	NE	NE										
4.E. Settlements	NE	NE	NE	NE	NE	NE										
4.F. Other land	NE	NE	NE	NE	NE	NE										
4.G. Harvested wood products	NE	NE														
4.H. Other	NA	NA	NA	NA	NA	NA										
5. Waste	T1	D	T1	D	T1	D										
5.A. Solid waste disposal			T1	D												
5.B. Biological treatment of solid waste			NE	NE	NE	NE										
5.C. Incineration and open burning of waste	NE	NE	NE	NE	NE	NE										
5.D. Waste water treatment and discharge			T1	D	T1	D										
5.E. Other	NO	NO	NO	NO	NO	NO										
6. Other (as specified in summary 1)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Abbreviations: T1 - Tier 1 method; D - Default; NA - Not Applicable; NE - Not Estimated; NO - Not Occurring

1.3.2 Data sources

The data for GHG inventory for the years 2023 and for the period 2018-2023 for different sectors and sub-sectors were collected using the two approaches i.e. first the “top down” or reference approach and second the “bottom up” or sectoral approach. The data for each sector and sub-sector were compiled from various sources primarily using available national data, data collected and published by the Vanuatu National Statistics Office (VNSO), Census (Population and Agriculture), Utilities Regulatory Authority (URA), Vanuatu Customs Data, Public and Private sector (like Pacific Petroleum, Origin Energy, VUI, UNELCO etc.), and other statistical reports, studies, brochures and other country specific information sources. Where actual data was not available judgment of sectors experts was relied on mainly for AFOLU and Waste Sector. For example, the factors like annual per capita protein consumption, manure management systems, etc. were determined based on the judgement of sectoral experts. Furthermore, the human, livestock census and national forest inventory are not conducted on annual basis, hence splicing techniques like interpolation and extrapolation were used to establish data for the entire time series.

The challenges and barriers faced during the data collection and methodologies adopted for data collections discussed in detail in the following section of the report and under sectoral and sub-sectoral analysis. A number of country specific and regional assumptions were used to represent the local conditions of country (highlighted in the following section of this report). These assumptions have been verified with the local sector experts and cross checked with other resources for correctness. Wherein no formal data is available, emission for those sectors and sub-sector are not considered/estimated in this report. Justification on choice of data and limitations discussed in following section of the report and under the sectoral/sub-sectoral analysis.

1.4. Brief description of key categories

A key source category has a significant influence on a country’s total inventory of direct greenhouse gases in terms of absolute level of emissions, the trend in emissions, or both. Vanuatu has identified the key categories for the inventory using the Tier 1 level and trend assessments as recommended in the IPCC 2006 Guidelines (Volume 1, Chapter 4) and adopted by the MPGs. This approach identifies sources that together contribute to 95 per cent of the total emissions or 95 per cent of the trend of the inventory in absolute terms.

A key category has a significant influence on a country’s total inventory of direct greenhouse gases in terms of absolute level of emissions, the trend in emissions, or both. Vanuatu has identified the key sources for the inventory using the tier 1 level and trend assessments as recommended in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006). This approach identifies sources that contribute to 95 per cent of the total emissions or 95 per cent of the trend of the inventory in absolute terms.

When the LULUCF sector is included in the analysis, Vanuatu has identified the sectors as the key categories in the order of their contribution to the total national GHG emissions and presented in table 1.3 (level assessment) and table 1.4 (trend assessment).

Table 1.3: Key Category Analysis (KCA) results (without LULUCF sector): Level assessment

Category code	Category	Greenhouse gas	Level Assessment (%)	Cumulative (%)
3.A	Enteric Fermentation	METHANE (CH_4)	43%	43%
1.A.3.b	Road Transportation	CARBON DIOXIDE (CO_2)	15%	58%
3.B	Manure Management	METHANE (CH_4)	13%	71%
3.B	Manure Management	NITROUS OXIDE (N_2O)	9%	80%
1.A.1	Energy Industries	CARBON DIOXIDE (CO_2)	9%	88%
5.A	Solid Waste Disposal	METHANE (CH_4)	3%	92%
1.A.2	Manufacturing industries and construction	CARBON DIOXIDE (CO_2)	3%	94%
1.A.3.d	Water-borne Navigation	CARBON DIOXIDE (CO_2)	2%	96%

Table 1.4: Key Category Analysis (KCA) results (without LULUCF sector): Trend assessment

Category code	Category	Greenhouse gas	Level Assessment (%)	Cumulative (%)
1.A.3	Transport	CARBON DIOXIDE (CO_2)	57%	57%
1.A.1	Energy Industries	CARBON DIOXIDE (CO_2)	16%	73%
1.A.3.a	Transport	NITROUS OXIDE (N_2O)	16%	89%
1.A.4	Other Sectors	CARBON DIOXIDE (CO_2)	9%	97%

When the LULUCF sector is included in the analysis, the most significant key categories is Forest Land remaining Forest Land (4A1). The full analyses are detailed in Annex I of this Report.

1.5. Brief general description of QA/QC plan and implementation

A Quality Assurance/Quality Control (QA/QC) Plan is a review mechanism that is an integral part of the process and was devised in order to improve transparency, consistency, comparability, completeness, and accuracy of national greenhouse gas inventory. An internal QA/QC plan was developed, and roles and responsibilities were defined for the First Biennial Transparency Report and GHG Inventory Team Members. The QA/QC process and review mechanism implemented at all levels of data collection, inventory preparation and reporting.

The inventory team routinely conducted checks consistency of the data and information provided by the different stakeholders (line ministries, government departments, Organizations, Public and private sector etc), to ensure data integrity, correctness, and completeness. In case of discrepancy or incompleteness, the inventory team consulted the relevant stakeholders and experts to reduce the data uncertainty, appropriate corrections, address errors and omissions. The sub-sectoral and sectoral calculations of GHGs were shared with the Technical Working Groups (TWGs) for technical review of categories and sub-category activity data, emission factors, estimation parameters, and calculation methods. The inputs provided by the TWGs were addressed and GHG emission reduction calculation was revised. On finalization of the GHG Inventory calculations, a draft report was prepared and shared with the TWGs.

Further, the draft report and GHG inventory calculations presented during the stakeholder consultation to seek inputs and finalize the report.

1.6. General uncertainty assessment, including data pertaining to the overall uncertainty of inventory totals

The uncertainty analysis on the national GHG inventory has been carried out as per the IPCC general guidance on uncertainty assessment[4]. The main objective of the uncertainty analysis is to identify the categories that have the greatest uncertainty contribution in the total GHG inventory estimation and the trend uncertainty with the objective of prioritizing improvements and distributing resources to reduce their uncertainties as much as possible. As per the 2006 IPCC Guidelines, Approach 1 i.e., analysis by using the error propagation equation, has been used. Approach 1 is based on error propagation and is used to estimate uncertainty in individual categories, in the inventory, and in trends between year 2023 and base year 1994. Uncertainties from disaggregated levels are combined by multiplying the default uncertainty values.

The overall uncertainty in national emissions i.e., Percentage uncertainty in total inventory was estimated as 75.82%; and the trend in national emissions between the base year and the current year has been estimated as 16,577.34%.

In Vanuatu, key uncertainties are associated with lack of high-quality, complete, country-specific, and recent data leading to the use of assumptions, default data, and splicing techniques.

1.7. General assessment of completeness

The IPCC Guidelines provides a comprehensive overview and categorization of all potential sources of GHG emissions; however not all of them are relevant to Vanuatu. Furthermore, there is insufficient data on certain sources for them to be included in this inventory exercise.

This has been discussed in the sections below, a detailed assessment of each IPCC category was carried out as part of Vanuatu's national GHG inventory, including each category's relevance to Vanuatu and the availability of data required to estimate emissions from these categories. The table 1.3 below provides a summary of completeness of the GHG inventory for the period 2018-2023.

Table 1.3. Summary of completeness of the national GHG inventory for year 2018-2023

Categories	Remarks
1. Energy	**Estimated**
1.A. Fuel combustion	Estimated
1.A.1. Energy industries	Estimated
1.A.2. Manufacturing industries and construction	NO
1.A.3. Transport	Estimated
1.A.4. Other sectors	Estimated
1.A.5. Other	NO
1.B. Fugitive emissions from fuels	NO
1.B.1. Solid fuels	NO
1.B.2. Oil and natural gas and other emissions from energy production	NO

[4] http://www.ipccnggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_3_Ch3_Uncertainties.pdf

1.C. CO2 transport and storage	NO
2. Industrial processes	**NO**
2.A. Mineral industry	NO
2.B. Chemical industry	NO
2.C. Metal industry	NO
2.D. Non-energy products from fuels and solvent use	NO
2.E. Electronic Industry	NO
2.F. Product uses as ODS substitutes	NO
2.G. Other product manufacture and use	NO
2.H. Other	NO
3. Agriculture	**Estimated**
3.A. Enteric fermentation	Estimated
3.B. Manure management	Estimated
3.C. Rice cultivation	NO
3.D. Agricultural soils	NE
3.E. Prescribed burning of savannahs	NO
3.F. Field burning of agricultural residues	NO
3.G. Liming	NO
3.H. Urea application	NE
3.I. Other carbon-containing fertilizers	NO
3.J. Other	NO
4. Land use, land-use change and forestry	**Estimated**
4.A. Forest land	Estimated
4.B. Cropland	NE
4.C. Grassland	NE
4.D. Wetlands	NE
4.E. Settlements	NE
4.F. Other land	NE
4.G. Harvested wood products	NE
4.H. Other	NO
5. Waste	**Estimated**
5.A. Solid waste disposal	Estimated
5.B. Biological treatment of solid waste	NE
5.C. Incineration and open burning of waste	NE
5.D. Waste water treatment and discharge	Estimated
5.E. Other	NO
6. Other	**NO**
Abbreviations: NA - Not Applicable; NE - Not Estimated; NO - Not Occurring	

1.8 Metrics

Consistent with paragraph 37 of the MPG, this Report is prepared using 100-year time-horizon global warming potential (GWP) values from the IPCC Fifth Assessment Report (AR5) and outlined in table 1.4 below:

Table 1.4. Global Warming Potential of various gases as per IPCC Fifth Assessment Report

Gas	GWP
CO_2	1
CH_4	28
N_2O	265

1.9 Summary of any Flexibility Applied

In accordance with the UNFCCC MPGs for the ETF (Annex to decision 18/CMA.1), a consistent annual time series starting from 1990 shall be reported. However, the starting year for the time series that is reported in the report is from year 1994 to 2023. Furthermore, due to limited time availability and availability of historical data, the activity data for each category is reported and presented from year 2007-2023. Efforts will be undertaken to acquire historical data to enhance the completeness of GHG inventory reporting in future inventory submission and we will continue to ensure time series consistency when the inventory time series starting from year 1990 is included in future reports.

Chapter 2: Trends in greenhouse gas emissions and removals

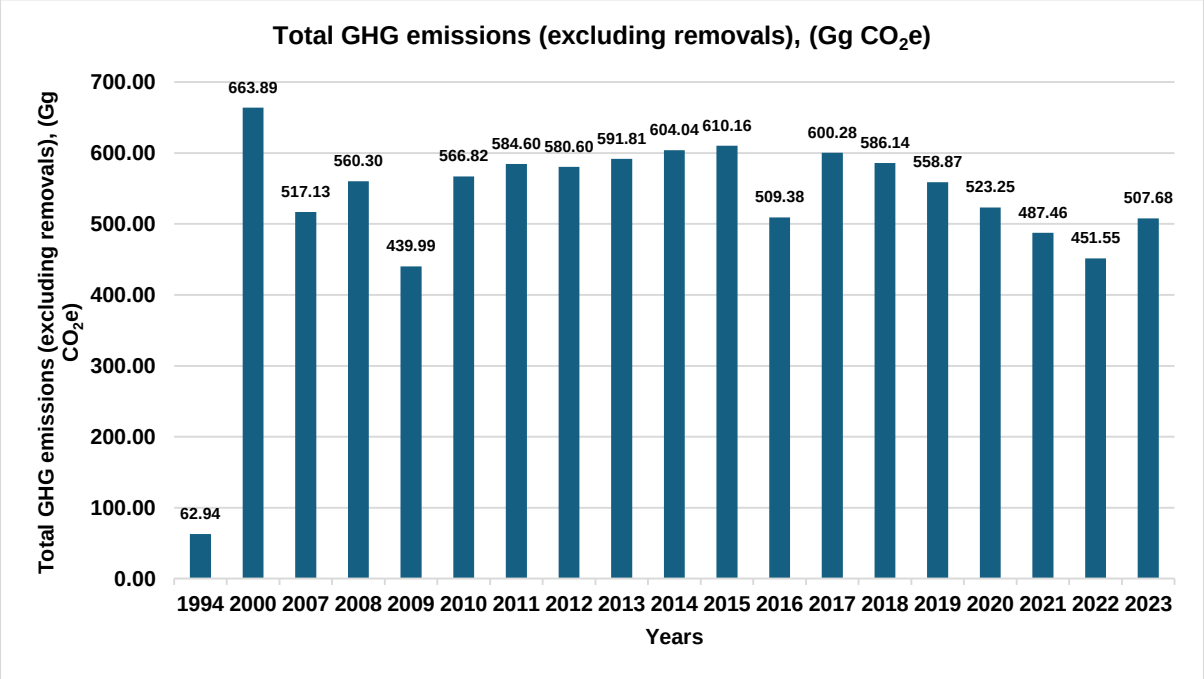
2.1. Description of emission and removal trends for aggregated GHG emissions and removals

2.1.1 Overview of emissions trends since 1994

The trends in emissions of the greenhouse gases in Vanuatu over the period 1994-2023 are shown in Figure 2.1 and 2.2.

Vanuatu's total greenhouse gas emissions (excluding removals) increased from 62.94 Gg CO_2e in 1994 to 507.68 Gg CO_2e in 2023. This represents an increase of 707% compared to 1994. Emissions peaked in the year 2000 amounting to 663.89 Gg CO_2e, which is the highest level of GHG emissions ever reported in Vanuatu. Post-2000, emissions declined to 517.13 Gg CO_2e in 2007 but remained consistently high compared to 1994. There was a subsequent increase, reaching 566.82 Gg CO_2e in 2010, followed by a sharp decrease in 2009 reaching 439.99 Gg CO_2e. Between 2011 and 2015, emissions showed minor fluctuations but remained within the 584.60 – 610.16 Gg CO_2e range. In 2016, there was a sharp decrease in emissions (509.38 Gg CO_2e) followed by a peak of 600.28 Gg CO_2e in 2017. The emissions have decreased during the years 2018 to 2022 from 584.64 Gg CO_2e in 2018 to 451.55 Gg CO_2e in 2022 respectively. This is attributed due to the decreased economic growth and global COVID-19. In 2023, total greenhouse gas emissions amounted to 507.68 Gg CO_2e which is 12% higher than 2021.

Figure 2.1: Total GHG emissions (excluding removals) per year, Gg CO_2e



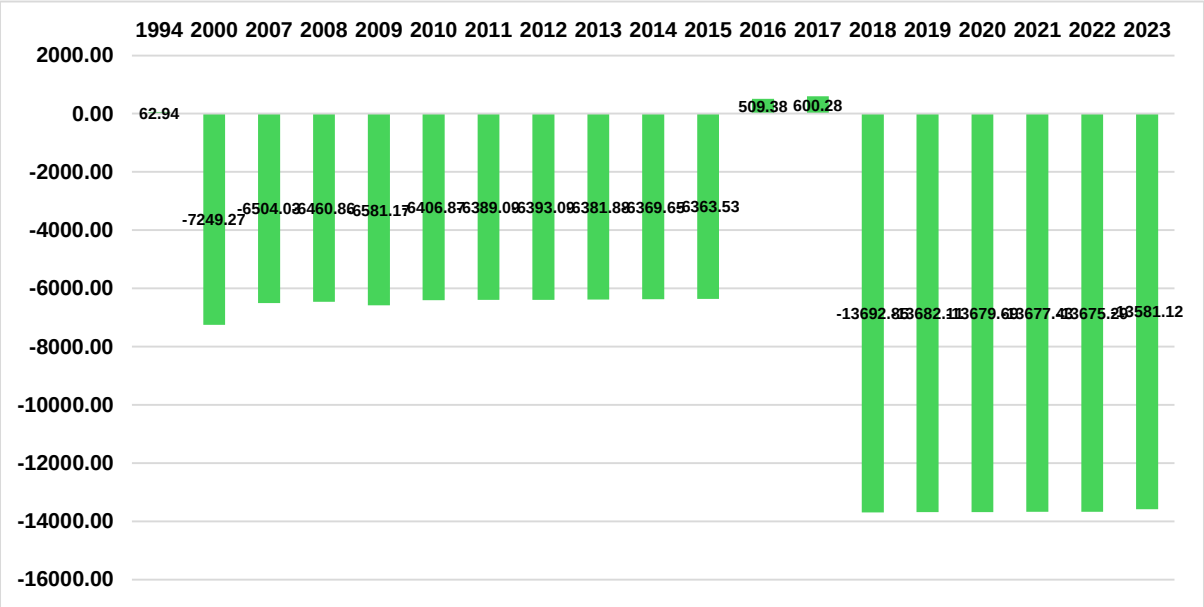
Furthermore, a comparison of emissions from the NDC reference period (2010) has also been made and presented in table 2.1 below. The comparison reveals that the emissions from the Energy sector has increased over the period 2010-2023 by 29%. While emissions from the agriculture sector shows decreasing trend during the period (-21%) due to decline in livestock population mainly ruminant species (cattle and swine). Furthermore, waste sector also shows decreasing trend (-23%) mainly attributed due to improving waste management practices in the country. By and large the GHG emissions (excluding removals) shows a decrease in trend by 10% during the period 2010-2023.

Table 2.1: Comparison of 2023 emissions with past emissions levels by sector, CO_2e and percent change (%)

Emissions Sector	2023 emissions (Gg CO_2e)	1994 emissions (Gg CO_2e)	% change in 2023 since 1994	2010 emissions (Gg CO_2e)	%change in 2023 since NDC Reference period (2010)
1. Energy	154.51	62.94	146	119.66	29
2. Industrial Processes and Product Use	NO	NO	-	NO	-
3. Agriculture	328.40	NE	100	414.91	-21
4. Land use, land use change and forestry	-14,088.79	NE	100	-6,973.69	102
5. Waste	24.77	NE	100	32.24	-23
Total emissions (excluding removals), Gg CO_2e	**507.68**	**62.94**	**707**	**566.82**	**-10**
Total emissions (with removals), Gg CO_2e	**-13,581.12**	**62.94**	**-21,680**	**-6,406.87**	**112**
Abbreviations: NO= Not Occurring					

However, Vanuatu is net carbon negative, since the Land Use, Land Use Change and Forestry (LULUCF) sector is a net sink of CO_2 in Vanuatu. In 2023, the net GHG emissions amounted to with –13,581.12 Gg CO2e in 2023.

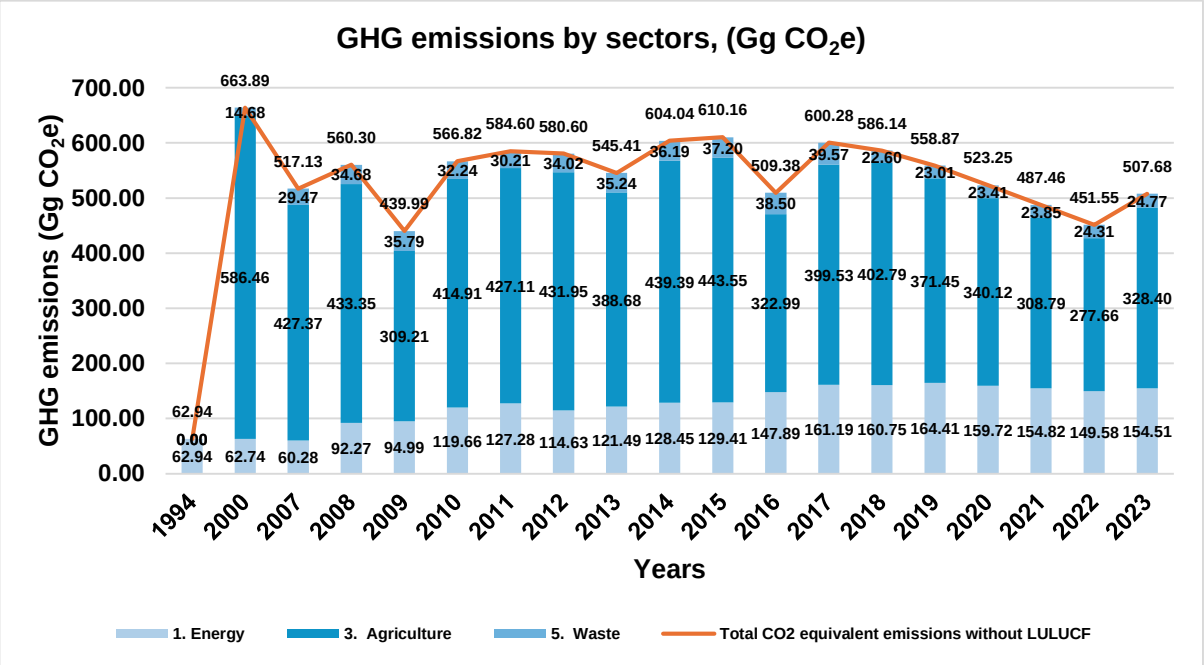
Figure 2.2: Total net GHG emissions per year, Gg CO_2e[5]



2.2. Description of emission and removal trends by sector and by gas

The following sections present Vanuatu's emissions trends by sector and by greenhouse gases for the time series 1994 to 2023. The total GHG emissions (excluding removals) from Vanuatu presented in the following figure 2.3.

Figure 2.3: Total GHG emissions per year (excluding removals), Gg CO_2e



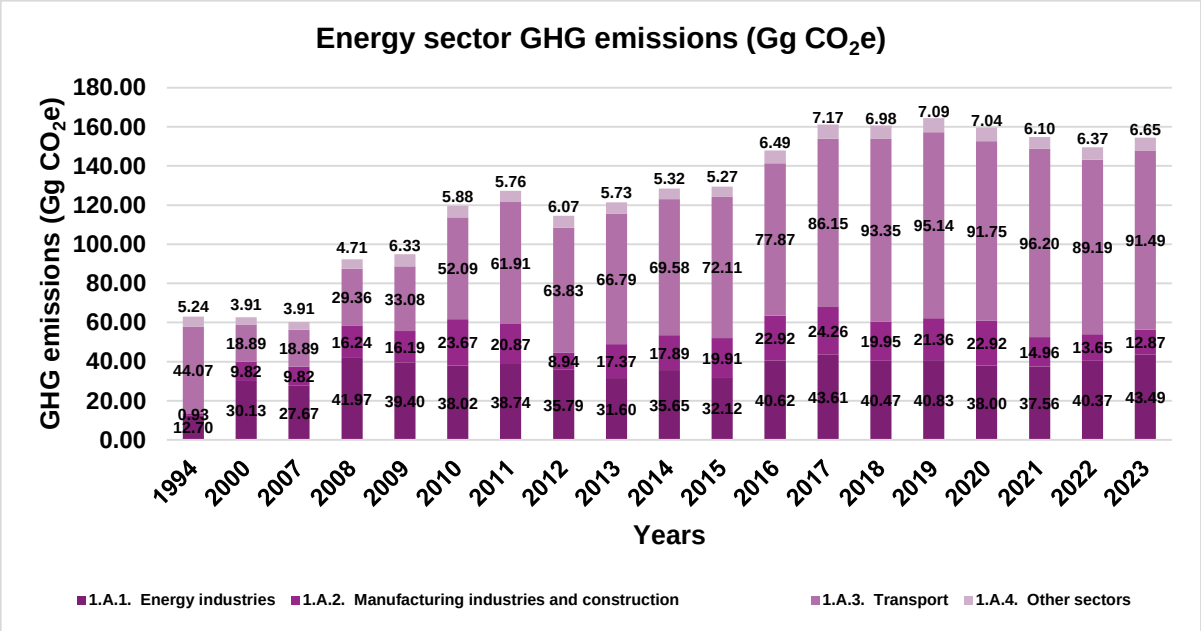
As can be seen in figure 2.3, the key sector with increasing emissions over the period 1994-2023 includes the Energy sector (increased by 145.50%). While Agriculture sector and waste sector represents a decreasing trend mainly due to decline in livestock population and improved waste management practices in the country. A detailed analysis of the trend in each sector is discussed in following subsections.

2.2.1 Sectoral trends

Energy sector

The energy sector is the second largest GHG emissions contributing sector in the Vanuatu's total national GHG inventory (excluding removals). The energy sector and sub-sectors emissions shows an increasing trend over the period 1994-2023. This is mainly due to the increasing energy demand from the rising population of the country and increase economic activity.

Figure 2.4: Energy sector GHG emissions per year (excluding removals), Gg CO_2e

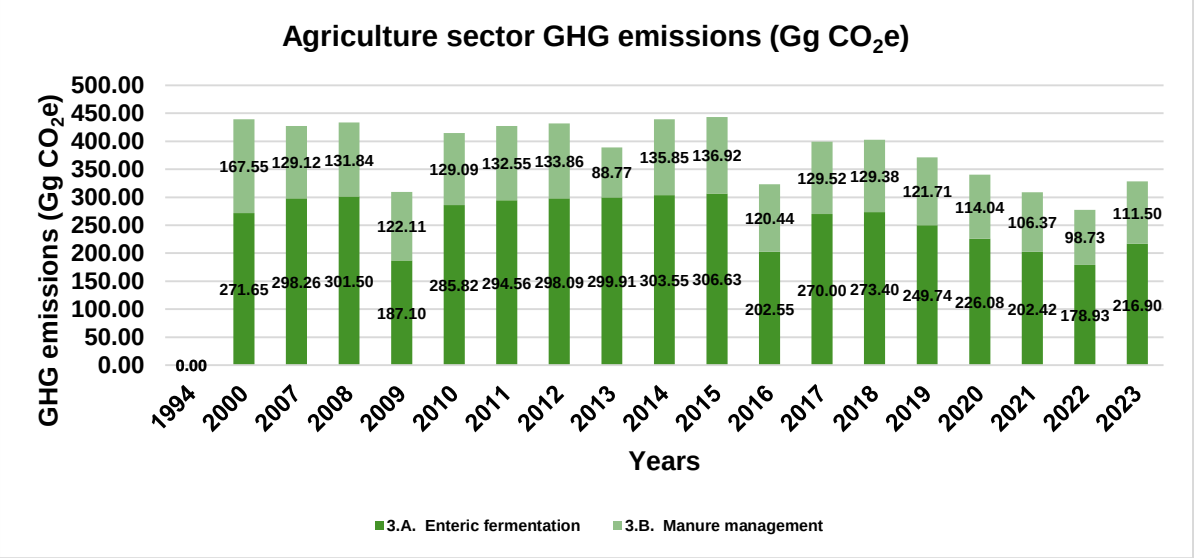


During 1994-2023, the emissions from energy industries (electricity generation) increased by 242% despite the increase of renewable energy in the generation mix[6]. Manufacturing industries and construction shows highest increase (1283%) followed by energy industries, transport (107%) and Other sectors (27.02%). This is driven by the needs of the growing population and expanding economy. .

Agriculture sector

The agriculture sector is the largest GHG emissions contributing sector to the Vanuatu's total national GHG emissions (excluding removals). As can be seen in figure 2.5, the emissions show a decreasing trend in both Enteric fermentation and Manure management, mainly attributed to the decrease in livestock population. The emissions from agriculture sector were not estimated for the year 1994. By way comparison the overall emissions from this sector have decreased by 44% during the period 2000-2023. During this period the emissions from enteric fermentation and manure management have decreased by 20.15% and 33.45% respectively.

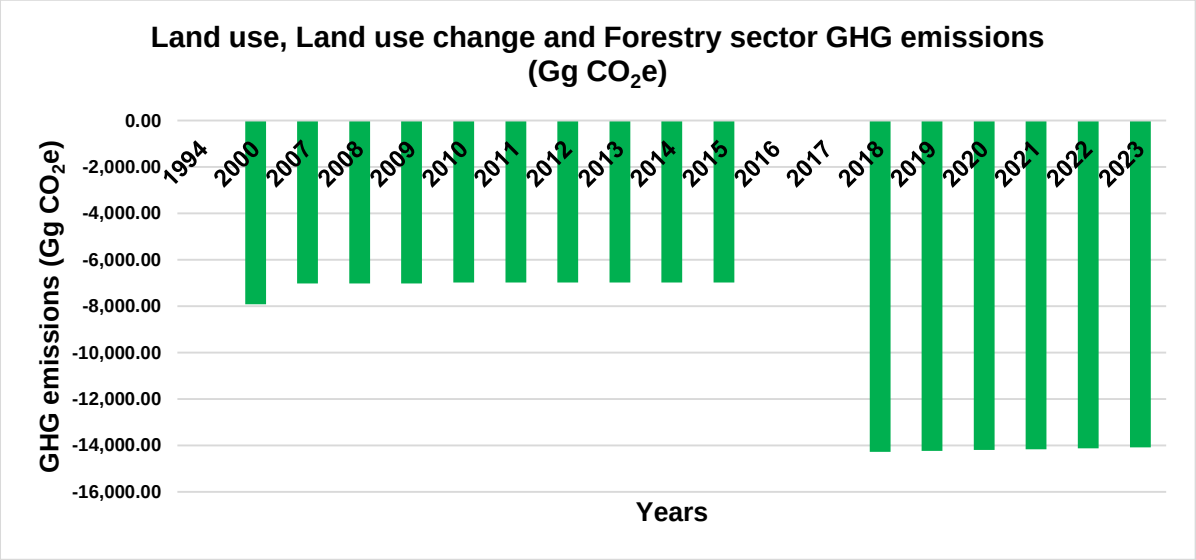
Figure 2.5: Agriculture sector GHG emissions per year (excluding removals), Gg CO_2e



Land use, land-use change and forestry (LULUCF)

The figure 2.6 below, presents the GHG emissions from the LULUCF sector mainly from the Forest land remaining forest land. As discussed above the republic of Vanuatu is net carbon negative, since the land-use change and forestry sector is a net sink of CO_2 in Vanuatu.

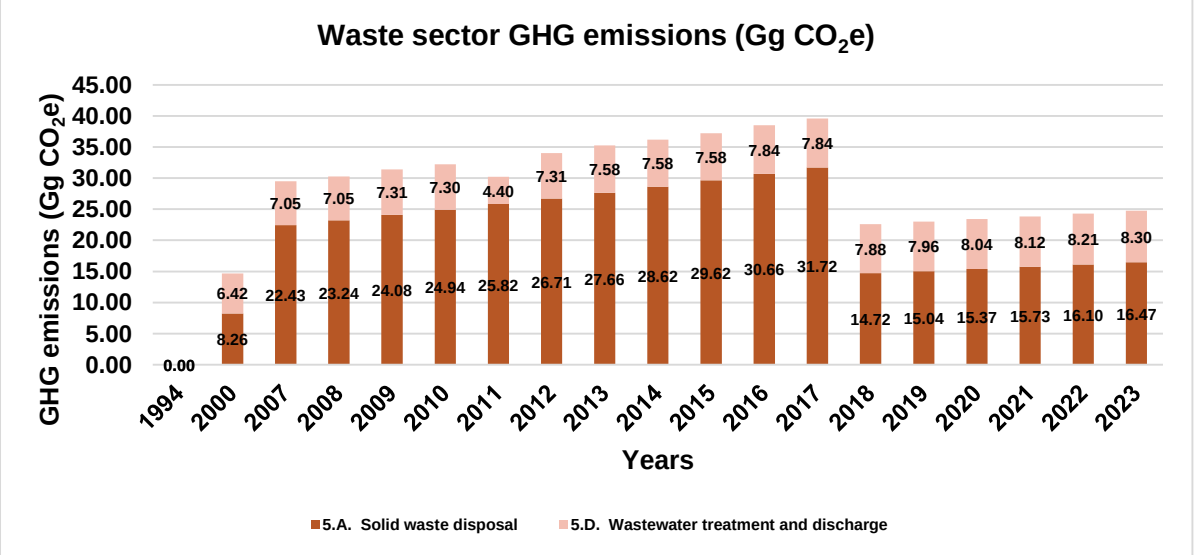
Figure 2.6: Land use, land-use change and forestry sector GHG emissions per year (excluding removals), Gg CO_2e[7]



Waste sector

The GHG emissions from waste sector was 24.77 Gg CO_2e in 2023. Waste sector emissions were not estimated during year 1994. While in the absence of actual monitored data for the period 2007-2017, the MSW generation in Vanuatu estimated from the urban population of Port Vila, Luganville and Lenakel and using average 1-1.5 kg/person/day. Whereas, for year 2018-2023, the MSW generation rate of 89.1 kg/capita/year has been used for estimating the GHG emissions. By and large, the waste sector emission has increased over the period 1994-2023 and is mainly due to increase in population and increasing consumption pattern of population.

Figure 2.7: Waste sector GHG emissions per year (excluding removals), Gg CO_2e



2.2.2 Trends by gas

Table 2.2 and show the individual GHG emissions and the values of total emissions for the time series 1994-2023.

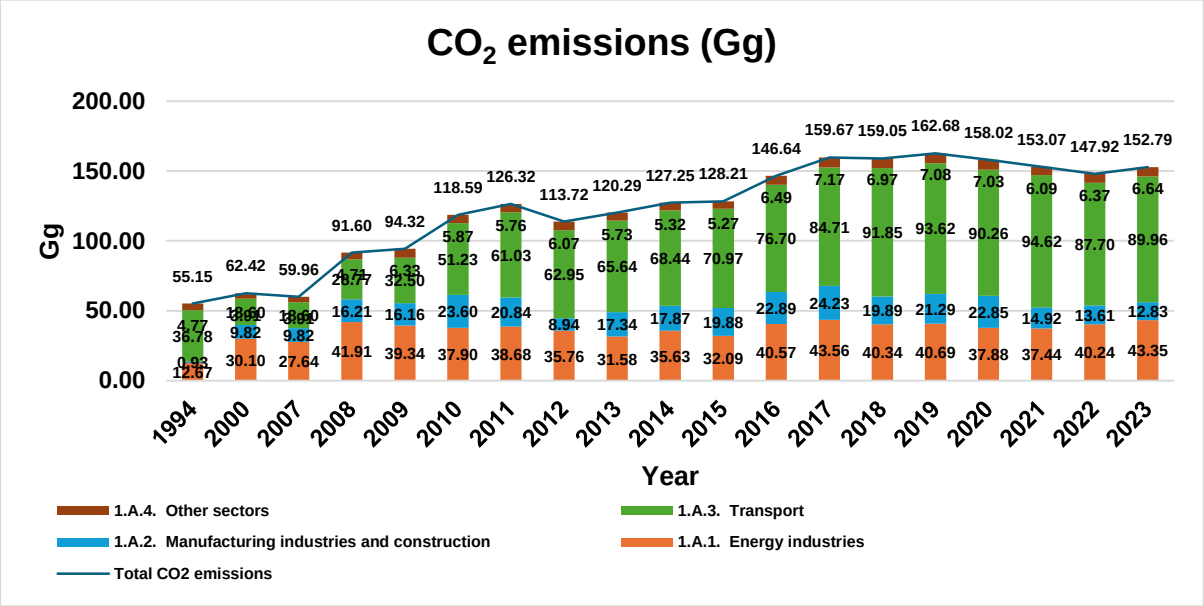
Table 2.2: Greenhouse gas emissions Gg CO_2e (excluding removals)

Year	CO_2	CH_4	N_2O	CO_2e
1994	55.15	0.07	7.71	62.94
2000	62.42	448.32	153.15	663.89
2007	59.96	393.57	63.60	517.13
2008	91.60	404.04	64.66	560.30
2009	94.32	299.29	46.38	439.99
2010	118.59	385.74	62.49	566.82
2011	126.32	397.07	61.22	584.60
2012	113.72	402.22	64.66	580.60
2013	120.29	405.78	19.35	545.41
2014	127.25	410.54	66.25	604.04
2015	128.21	414.90	67.05	610.16
2016	146.64	304.98	57.77	509.38
2017	159.67	378.34	62.28	600.28
2018	159.05	365.29	61.80	586.14
2019	162.68	338.72	57.48	558.87
2020	158.02	312.13	53.10	523.25
2021	153.07	285.58	48.82	487.46
2022	147.92	259.21	44.43	451.55
2023	152.79	303.24	51.65	507.68
% difference 1994-2023	**177%**	**424619%**	**570%**	**707%**
% in 2023	**30%**	**60%**	**10%**	**100%**
% difference 2010-2023	**29%**	**-21%**	**-17%**	**-10%**

Carbon dioxide (CO_2)

The energy sector and it's sub-sectors are the main source of CO_2 emissions, accounting for approximately 100% of CO_2 emissions (excluding LULUCF sector as it is a net sink). The CO_2 emissions from Vanuatu has shown the increasing trend during 1994-2023, the CO_2 emissions in year 1994 was 55.15 Gg and increased to 152.79 Gg in 2023, indicating increase by 177%. The combustion of fossil fuels remains the main contributor of CO_2 emissions in Vanuatu.

Figure 2.8: CO_2 emissions (excluding removals), Gg



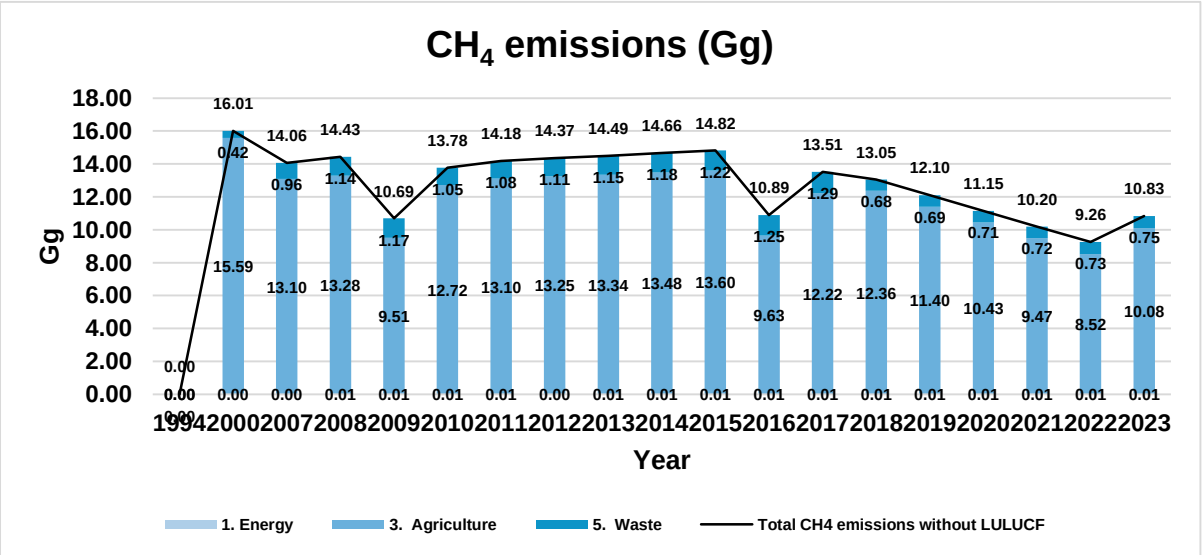
Within the energy sector, the transport sector is the key CO_2 emitting sector followed by energy industries, manufacturing industries and construction, and the other sector (Commercial/institutional and residential) respectively.

Methane (CH_4)

About 93% of Methane emission in Vanuatu comes from the agriculture sector i.e. from Livestock- Cattle, Swine, Horses, Goat and Chicken; enteric fermentation and manure management. The waste sector (Solid waste -MSW, Wastewater) is the second largest source of CH_4 emissions, accounting about 6.9% of emissions. Minor fraction of methane comes from the energy sector; mainly as the emissions from combustion of fossil fuel (0.01%).

In 2023, Methane emissions was 10.783 Gg compared to 16.01 Gg in 2000, indicating a decrease by 32.36% over the period 2000-2023.

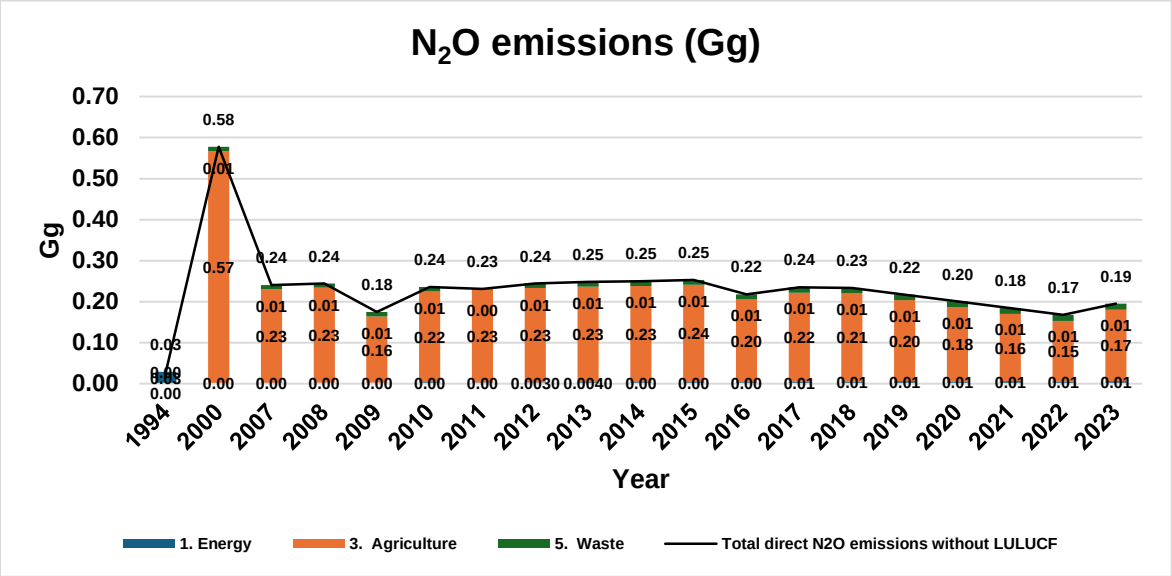
Figure 2.9: CH_4 emissions (excluding removals), Gg



Nitrous oxide (N_2O)

The Nitrous oxide (N_2O) emissions in Vanuatu was 0.19 Gg in 2023 and 0.03 Gg in 1994, which indicates an increase of about 17.34% during the period 1994-2023. The main source of N_2O emissions in Vanuatu is from livestock manure management (89%), Wastewater treatment and handling (8%) and energy sector (3%) mainly transport sector tail gas emissions (mobile combustion) and minor emission from stationery combustion.

Figure 2.10: N_2O emissions (excluding removals), Gg



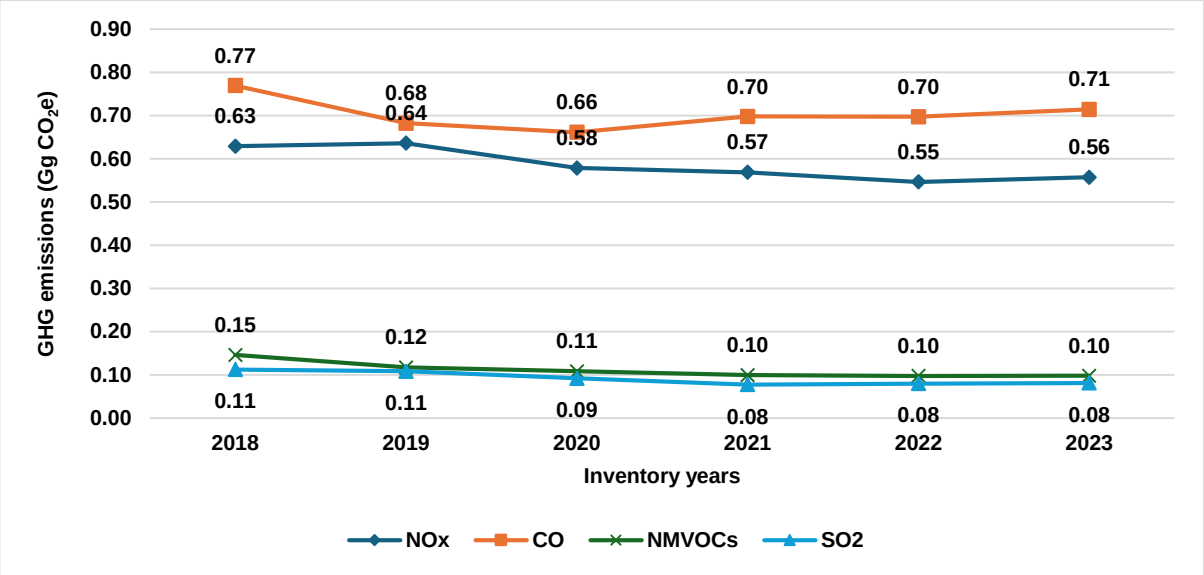
Other GHGs (PFCs, HFCs and SF6)

Emissions from per-fluorocarbons (PFCs), hydrofluorocarbons (HFCs) and Sulphur hexafluoride (SF6) in Vanuatu is negligible as the products containing these gases are not produced in the country. Emissions from the consumption of Halocarbons and SF6 were not estimated due to lack of activity data.

Indirect Greenhouse Gases (NOx, CO, NMVOC and SO_2)

Apart from the direct GHG emissions in Vanuatu, the other indirect emissions of NOx, CO, NMVOC and SO_2 takes place; however, they are not main source of the GHGs and are of small quantum. The emissions of indirect gases were not accounted under this GHG inventory submitted under previous national communications (First, Second and Third National Communications and the First Biennial Update Report). Vanuatu has estimated emissions of this gases for the first time under this national GHG inventory. Hence the trends of these gases are available for the inventory years 2018-2023 and are presented in the figure 2.11 below.

Figure 2.10: Indirect Greenhouse Gases (NOx, CO, NMVOC and SO_2), Gg: 2018-2023



Chapter 3: Energy (CRT sector 1)

3.1. Overview of the sector

In line with the 2006 IPCC Guidelines, following are the categories that are covered in the energy sector of Vanuatu.

- 1.A.1. Energy Industries;
- 1.A.2 Manufacturing Industries and Construction;
- 1.A.3 Transport;
- 1.A.4 Other sectors (Commercial/Institutional, Residential)

In the year 2023, the total emission from energy sector was 154.51 Gg CO_2e which contributed 30.43% to the total national GHG emissions (excluding removals).

The inventory covers the following in the sector:

− greenhouse gases: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O);

− indirect gases: nitrogen oxides (NOx), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs), sulphur dioxide (SO_2).

In 2023, the Energy sector emitted 100% of the total national CO_2 emissions. The Energy sector emissions in Vanuatu are mainly occurring due to the activities related to Fuel Combustion (category 1.A). The fuel combustion activities, comprises of Category 1A Activities related to Fuel Combustion includes the following subcategories:

- 1.A.1. Energy Industries (28.15%);
- 1.A.2 Manufacturing Industries and Construction (8.33%);
- 1.A.3 Transport (59.22%);
- 1.A.4 Other sectors (Commercial/Institutional, Residential) (4.30%).

Following table 3.1 and figure 3.1 gives the relative distribution of GHG emissions across the energy sector for the time series 1994-2023.

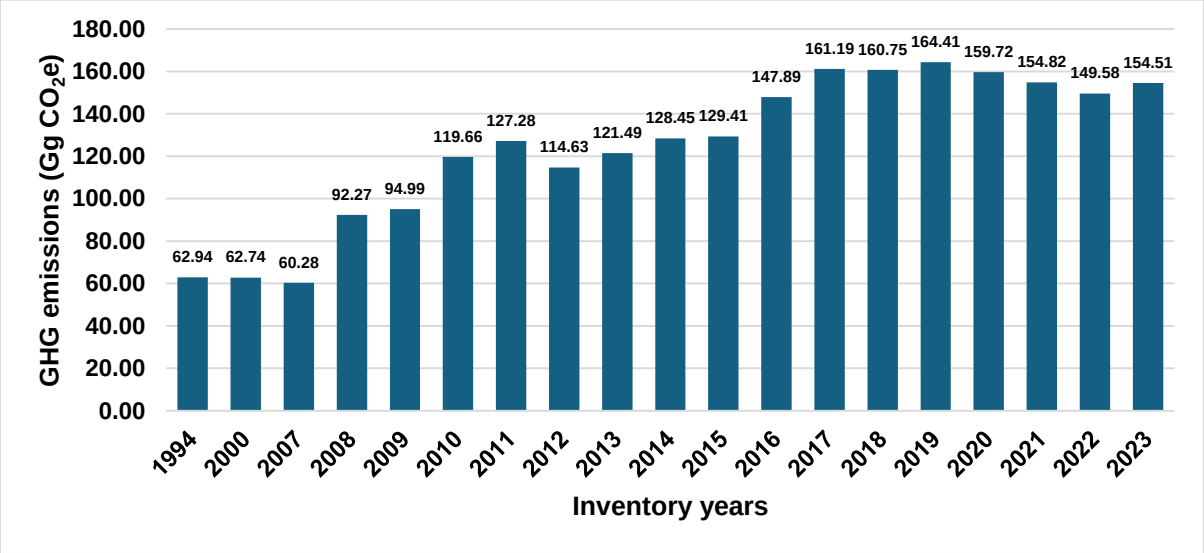
Table 3.1: Energy Sector Emissions (in Gg CO_2e): 1994 - 2023

Categories and Sub-categories	1994	2000	2007	2008	2009	2010	2011	2012	2013	2014
1 - Energy	**62.94**	**62.74**	**60.28**	**92.27**	**94.99**	**119.66**	**127.28**	**114.63**	**121.49**	**128.45**
1.A - Fuel Combustion Activities	**62.94**	**62.74**	**60.28**	**92.27**	**94.99**	**119.66**	**127.28**	**114.63**	**121.49**	**128.45**
1.A.1 - Energy Industries	12.70	30.13	27.67	41.97	39.40	38.02	38.74	35.79	31.60	35.65
1.A.2. Manufacturing industries and construction	0.93	9.82	9.82	16.24	16.19	23.67	20.87	8.94	17.37	17.89
1.A.3 - Transport	44.07	18.89	18.89	29.36	33.08	52.09	61.91	63.83	66.79	69.58
1.A.4 - Other Sectors	5.24	3.91	3.91	4.71	6.33	5.88	5.76	6.07	5.73	5.32

Categories and Sub-categories	2015	2016	2017	2018	2019	2020	2021	2022	2023
1 - Energy	**129.41**	**147.89**	**161.19**	**160.75**	**164.41**	**159.72**	**154.82**	**149.58**	**154.51**

1.A - Fuel Combustion Activities	**129.41**	**147.89**	**161.19**	**160.75**	**164.41**	**159.72**	**154.82**	**149.58**	**154.51**
1.A.1 - Energy Industries	32.12	40.62	43.61	40.47	40.83	38.00	37.56	40.37	43.49
1.A.2. Manufacturing industries and construction	19.91	22.92	24.26	19.95	21.36	22.92	14.96	13.65	12.87
1.A.3 - Transport	72.11	77.87	86.15	93.35	95.14	91.75	96.20	89.19	91.49
1.A.4 - Other Sectors	5.27	6.49	7.17	6.98	7.09	7.04	6.10	6.37	6.65

Figure 3.1: Energy Sector Emissions (in Gg CO_2e): 1994 - 2023



3.2. Fuel combustion (CRT 1.A)

3.2.1 Category overview

In category 1.A Fuel Combustion Activities, emissions of CO_2, CH_4, N_2O, CO, NOx, NMVOCs, and SO_2 were estimated. Emissions were estimated for the following subcategories:

- 1.A.1 Energy Industries;
- 1.A.2 Manufacturing Industries and Construction;
- 1.A.3 Transport;
- 1.A.4. Other Sectors

Vanuatu is net importer of petroleum product. Emissions from fuel combustion activities are mainly due to combustion of liquid fuels (Diesel, Gasoline, Aviation Gasoline, Jet Kerosene, Kerosene, and Liquefied Petroleum Gas (LPG). The following table present summary of total fuel consumption in energy sector for the inventory year 2023 and inventory period 2007-2023. Further, the methodologies for estimating emissions from fossil fuel combustion are described in this chapter.

Table 3.2: Fuel Consumption in Energy Sector- Fuel Combustion Activities: 2007- 2023

Inventory year	Aviation Gasoline (AVG)	Gasoline/Petrol	Gas / Diesel Oil	Jet Kerosene (DPK)	Kerosene	Liquefied Petroleum Gas (LPG)
	Litres	Litres	Litres	Litres	Litres	Ton
2007		3283011	19190627		237740	430
2008		5323700	29442795		337480	687
2009		5835901	29251597		202400	1271
2010	170268	7924825	35079519	4798261	163499	1750
2011	310414	8683772	37055031	7805206	123500	1321
2012	374912	8745602	35197911	8171266	92450	1737
2013	578495	8715936	35306983	9526270	76400	1684
2014	467224	8804065	36070471	11828233	41000	1610
2015	523164	8990919	37321545	11490630	28800	1584
2016	529879	9293113	42718445	2333335	29601	1682
2017	644455	9577435	46775654	2623705	98400	1834
2018	551592	9688259	46970685	12866599	60000	2073
2019	537112	9744630	48025602	12674862	18000	2182
2020	602017	9952920	47833199	4688583	10400	2291
2021	429203	10034559	45567701	3789012	33400	2401
2022	634735	9958982	44348194	6286240	35000	2510
2023	571406	10285982	46305659	1448113	21420	2619

CO_2 emissions from fuel combustion were also estimated using the Reference Approach, and the Reference and Sectoral approach for estimating CO_2 emissions from fuel combustion were compared (further Section 3.2.1).

3.2.1. Comparison of the sectoral approach with the reference approach

In accordance with the 2006 IPCC Guidelines (volume 2, chapter 6) (IPCC 2006), Vanuatu estimates its CO_2 emissions from fuel combustion using a top-down reference approach independent of the sectoral approach. Under the reference approach, GHG emissions were estimated using only the fuel consumption data for each type of fuel Whilst these two approaches are not expected to match each other, significant differences between the reference and sectoral approaches may indicate problems in inventory data.

The results of estimated CO_2 emissions for the GHG inventory year 2023 using reference approach have been estimated and compared with the CO_2 emissions estimated using sectoral approach. The difference in estimates of CO_2 emissions from fuel combustion using the sectoral and reference approaches was within ±1%.

Table 2.3: Energy Sector CO_2 Emissions using Reference and Sectoral Approach: 2007-2023

Inventory Year	Reference Approach				Sectoral Approach		Difference	
	Apparent Consumption (TJ)	Excluded Consumption (TJ)	Apparent Consumption - Excluding Non-energy uses (TJ)	CO_2 Emission (Gg)	Energy Consumption (TJ)	CO_2 emission (Gg)	Energy Consumption (%)	CO_2 emission %

2007	823.077	8.828	814.248	59.576	820.309	59.959	-0.7%	-0.6%
2008	1272.523	28.061	1244.462	90.992	1254.144	91.603	-0.8%	-0.7%
2009	1305.337	26.770	1278.567	93.147	1297.223	94.324	-1.5%	-1.3%
2010	1780.061	147.613	1632.448	118.590	1632.448	118.590	0.0%	0.0%
2011	1965.532	146.494	1819.038	129.852	1838.778	126.320	-1.1%	2.7%
2012	1934.882	224.471	1710.411	124.146	1569.688	113.719	8.2%	8.4%
2013	1989.620	331.487	1658.134	120.290	1658.134	120.290	0.0%	0.0%
2014	2093.339	341.530	1751.809	127.251	1775.004	127.251	-1.3%	0.0%
2015	2132.400	367.824	1764.576	128.206	1764.576	128.206	0.0%	0.0%
2016	2311.042	296.642	2014.399	146.638	2044.317	148.816	-1.5%	-1.5%
2017	2530.766	338.196	2192.570	159.669	2530.766	179.109	-15.4%	-12.2%
2018	2574.639	388.410	2186.229	159.049	2209.761	160.758	-1.1%	-1.1%
2019	2610.602	371.196	2239.406	162.919	2257.300	164.220	-0.8%	-0.8%
2020	2333.353	159.855	2173.498	158.022	2190.295	159.244	-0.8%	-0.8%
2021	2223.311	115.895	2107.416	153.071	2107.423	153.071	0.0%	0.0%
2022	2278.033	233.687	2044.346	148.388	2037.599	147.915	0.3%	0.3%
2023	2189.211	84.484	2104.727	152.787	2104.735	152.788	0.0%	0.0%

3.2.2 International bunker fuels

The 2006 IPCC Guidelines require emissions from international aviation and marine bunkers to be reported separately to the national total emissions from the energy sector (IPCC 2006). They are instead reported as memo items (CRT table 1.D.1). Total CO_2 emissions from International Aviation and International Waterborne Navigation for the year 2023 are estimated and presented in the following table 3.4 below, while emissions from other gases were insignificant. These emissions are not counted under national total GHG emissions. Activity data for both international marine and aviation bunkers are estimated by the Department of Energy (DOE).

Table 3.4: International Bunkers Emissions (Gg CO_2e): 1994-2023

Inventory years: 1994-2023	GHG emissions (Gg CO_2e)																		
Categories	**1994**	**2000**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
1.D.1. International bunkers	5.41	5.95	0.65	2.08	1.98	10.78	17.74	16.13	23.93	24.75	37.20	21.51	24.50	28.09	26.83	11.73	8.53	17.03	6.33
1.D.1.a. Aviation	NO	5.95	NO	NO	NO	7.33	13.50	13.73	17.51	22.99	29.62	20.42	23.09	25.58	24.82	6.69	4.22	12.37	0.64
1.D.1.b. Navigation	NO	NO	0.65	2.08	1.98	3.45	4.24	2.41	6.42	1.76	NO	1.09	1.41	2.51	2.01	5.04	4.31	4.66	5.69

3.2.3 Feedstocks and non-energy use of fuels

This category includes excluded carbon, which includes both stored carbon and carbon used and emitted as CO_2 in other sectors. This inventory does not include emissions from Feedstocks and non-energy use of fuels due to lack of data.

3.2.4 Energy industries (CRT category 1.A.1)

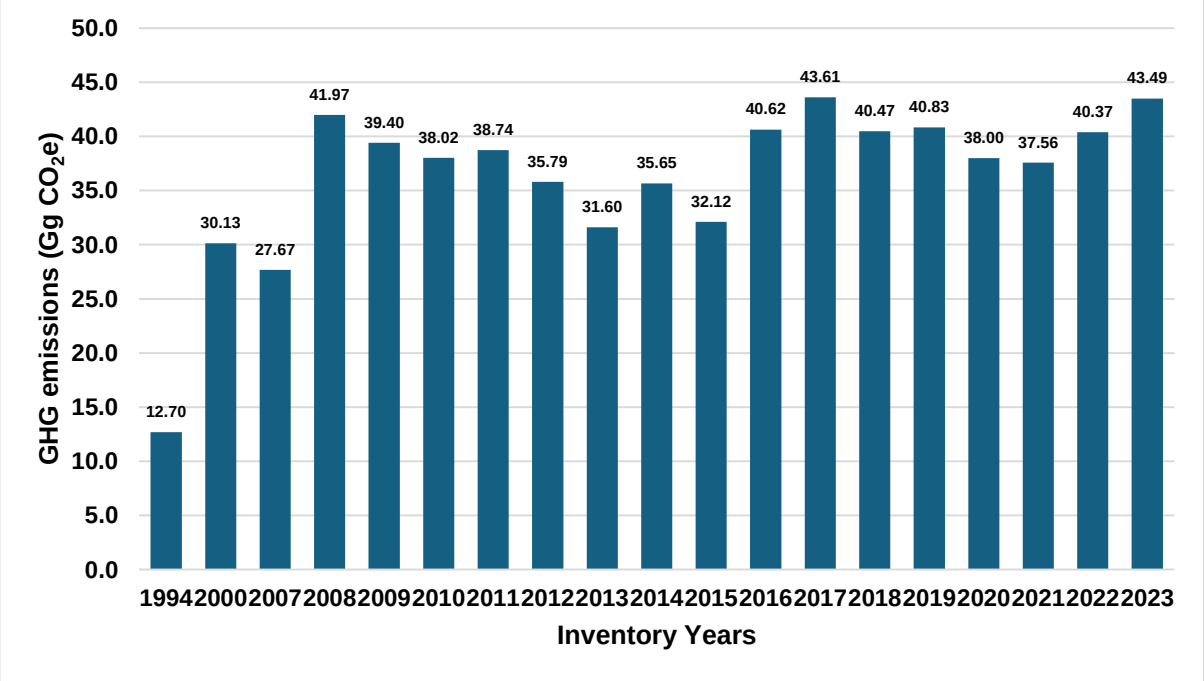
3.2.4.1 Category Description

This category includes emissions from fuel combustion for electricity generation.

Public electricity and heat production (CRT category 1.A.1.a)

Electricity generation accounted for approximately 8.57% of the total national emissions excluding removals in 2023. It is the second most GHG emissions contributing source within the Energy sector and amounts to about 43.49 Gg CO_2e which represents 28% of emissions from Energy sector. The major fuels consumed in the power plants for electricity generation in Vanuatu is diesel. The grid electricity generation is operated by two major electricity generation entities i.e. the Vanuatu Utilities and Infrastructure Limited (VUI) and UNELCO. The Utilities Regulatory Authority (the 'Authority') is established under the Utilities Regulatory Authority Act no. 11 of 2007 (as amended) as the economic regulator of electricity and water services in Vanuatu. URA issues electricity market update on monthly basis as well as Electricity Fact Sheet on regular basis. The fuel consumption data from these reports were used for estimating the GHG emissions for year 2023.

Figure 3.2: Energy industries (Electricity generation) emissions (in Gg CO_2e): 1994 - 2023



As can be seen in above figure, the emissions from the electricity generation activity have increased by 242% from 1994 to 2023.

Furthermore, the below table 3.5 presents the Indirect GHG emissions of NOx, CO, NMVOC and SO_2 gas from the Electricity generation.

Table 3.5: Indirect GHG emissions from Energy Industries (electricity generation) in Gg: 2023

Net Indirect Emissions (Gg)	NOx	CO	NMVOCs	SO_2
2018	0.04	0.01	0.00	0.03
2019	0.04	0.01	0.00	0.03
2020	0.03	0.01	0.00	0.02
2021	0.03	0.01	0.00	0.02
2022	0.04	0.01	0.00	0.03
2023	0.04	0.01	0.00	0.03

3.2.4.2. Methodological issues

The Tier 1 methodology of the 2006 IPCC 2006 Tier 1 Guidelines was used to estimate GHG emissions in Category 1.A. Energy Industries using default factors.

The estimates of greenhouse gas emissions from each type of fuel used for energy production was calculated using Equation 2.1 of the 2006 IPCC Guidelines, Vol. 2, Chapter 2, p. 2.11:

$$Emissions_{GHG} = \sum_{fuels} Emissions_{GHG,fuel} = \sum_{fuels} Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG,fuel}$$

Where:

$Emissions_{GHG,fuel}$= emissions of a given GHG by type of fuel (kg GHG)

$Fuel\ Consumption_{fuel}$ = amount of fuel combusted (TJ)

$Emission\ Factor_{GHG,fuel}$= default emission factor of a given GHG by type of fuel (kg gas/TJ).

Additionally, indirect GHG emissions NOx, CO, NMVOC and SO_2 are also estimated.

Equation 2.2 of the 2006 IPCC Guidelines, Vol. 2, Chapter 2, page 2.11 was used to calculate total GHG emissions for all fuel types used:

$$Emissions_{GHG} = \sum_{fuels} Emissions_{GHG,fuel}$$

Activity data

The Utilities Regulatory Authority (the 'Authority') is established under the Utilities Regulatory Authority Act no. 11 of 2007 (as amended) as the economic regulator of electricity and water services in Vanuatu. URA issues electricity market update on monthly basis as well as Electricity Fact Sheet on regular basis. The fuel consumption data from these reports were used for estimating the GHG emissions for year 2023. In 2023, URA reported to have consumed 4,013,601 Litres of Diesel for electricity generation.

Table 3.6: Fuel consumption data from Energy Industries (electricity generation)

Inventory year	Gas/Diesel Oil (Litres)	Gasoline/Petrol (Litres)
2007	10426117	–
2008	15808980	–
2009	14840500	–
2010	14295306	–
2011	14590904	800
2012	13489193	400
2013	11910108	400
2014	13438140	600
2015	12103880	800
2016	15301250	400
2017	16430490	0
2018	15216545	200
2019	15350431	–
2020	14287503	–
2021	14123063	–
2022	15177758	–
2023	16351715	–

Emission Factor

The emission estimates are computed using the IPCC default emission factors tabulated in the table below:

Table 3.7: Emission Factors used for estimating GHG emissions from electricity generation

Emission factor for Fuel	CO_2 (kg CO2/TJ)	CH_4 (kg CH_4/TJ)	N_2O (kg N_2O/TJ)
Diesel	74100	3	0.6
Gasoline	69300	3	0.6

Since the IPCC guidelines do not provide EFs for indirect GHGs such as NOX, CO, NMVOCs and SO_2, but proposes the EMEP / EEA Guidebook (2023) default Tier 1 EFs for estimating these emissions.

Table 3.8: Emission Factors used for estimating indirect GHG emissions from electricity generation

Emission factor for Fuel	NOx (g/GJ)	CO (g/GJ)	NMVOC (g/GJ)	SO_2 (g/GJ)
Diesel	65	16.2	0.8	46.5

3.2.4.3. Description of any Flexibility Applied

Flexibility for time series which starts from year 1994 to 2023 is applied as described in Section 1.9.

3.2.4.4. Uncertainty assessment and time series consistency

Uncertainty assessment will be reported in Annex II: Uncertainty Assessment.

3.2.4.5. Category-specific QA/QC and verification

Compliant with QA/QC plan and implementation as outlined in Chapter 1, Section 1.5.

3.2.4.6. Category-specific recalculations

There are no recalculations for this category.

3.2.4.7. Category-specific planned improvements

This will be reported separately under the Inventory Improvement Plan section of the report.

3.2.5 Manufacturing Industries and Construction (CRT category 1.A.2)

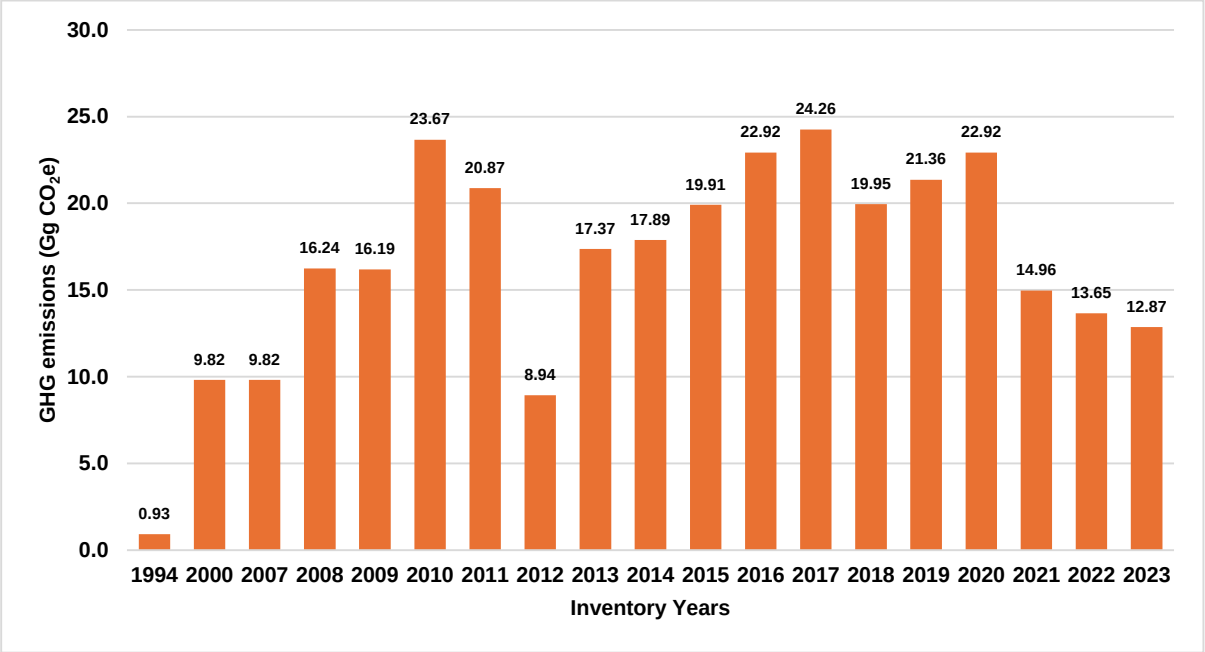
3.2.5.1 Category Description

In 2023, the manufacturing industries and construction sector emitted 12.87 Gg CO_2e, which was approximately 8.33% of total CO_2e emissions from the energy sector and 2.54% of total national GHG emissions (excluding removals). The emission from this sector is mainly CO_2 emission from the consumption of fossil fuel, and further sub-categorization of the fuel consumption in different industries is not available.

Vanuatu has a small light-industry sector mainly catering to the local market. The Manufacturing, Industry and Construction sub-sector comprises the manufacturing, construction, wholesale and retail sectors along with the fish processing, copra and various coconut products as well as beef industry. However, the fuel consumption and emissions of the export industries are subject to the international market condition.

The following figure 3.3 presents the total emissions from Manufacturing industries and construction for the time series 1994-2023.

Figure 3.3: Total emissions from Manufacturing industries and construction (in Gg CO_2e): 1994 - 2023



As can be seen in the above figure, the emissions from this category have increased by 1283% during 1994-2023. The emissions during the year 2021 to 2023 are lower relative to the previous years. This is attributed due to the slowdown of economic activities and global COVID-19 pandemic.

3.2.5.2 Methodological issues

For this category, the Tier 1 methodology of the 2006 IPCC Guidelines was used. The estimates of greenhouse gas emissions from each type of fuel used for manufacturing industries and construction was calculated using Equation 2.1 of the 2006 IPCC Guidelines, Vol. 2, Chapter 2, p. 2.11:

$$Emissions_{GHG} = \sum_{fuels} Emissions_{GHG,fuel} = \sum_{fuels} Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG,fuel}$$

Where:

$Emissions_{GHG,fuel}$= emissions of a given GHG by type of fuel (kg GHG)

$Fuel\ Consumption_{fuel}$ = amount of fuel combusted (TJ)

$Emission\ Factor_{GHG,fuel}$= default emission factor of a given GHG by type of fuel (kg gas/TJ).

Additionally, indirect GHG emissions NOx, CO, NMVOC and SO_2 are also estimated.

Equation 2.2 of the 2006 IPCC Guidelines, Vol. 2, Chapter 2, page 2.11 was used to calculate total GHG emissions for all fuel types used:

$$Emissions_{GHG} = \sum_{fuels} Emissions_{GHG,fuel}$$

Indirect GHG emissions NOx, CO, NMVOC and SO_2 are not estimated of this subcategory due to lack of data on industry type and the related activities.

Activity data

The fuel consumed in this subcategory are Diesel, Gasoline, Kerosene and LPG and their quantities are presented in table below

Table 3.9: Activity data used for estimating GHG emissions from manufacturing industries and construction: 2007-2023

Inventory years	Gas / Diesel Oil (litres)	Gasoline/Petrol (litres)	Kerosene (litres)	Aviation Gasoline (AVG) (litres)	Jet Kerosene (DPK) (litres)	Liquefied Petroleum Gas (LPG) (Ton)
2007	2895365	681400	81700	-	-	128
2008	4808785	1144900	97260	-	-	205
2009	4715083	1028200	56200	-	-	394
2010	6749177	1528000	52000	800	329500	421
2011	6110188	1456424	33600	-	-	417
2012	1530830	1530830	62700	200	200	413
2013	4903411	1321900	59000	1034	-	396
2014	5114873	1351663	29000	-	-	388
2015	5802046	1427919	23400	200	-	399
2016	7241013	1280269	26201	800	200	239
2017	7699662	1273405	92800	1200	-	229
2018	6157687	1087362	57800	-	5000	311
2019	6475860	1361000	16200	-	2600	327
2020	6861220	1580730	8600	-	6181	344
2021	4640209	639700	33200	-	-	360
2022	4289891	450100	34800	-	-	377
2023	4013601	425031	21420	-	-	393

Emission Factor

The emission estimates are computed using the IPCC default emission factors tabulated in the table below:

Table 3.10: Emission Factors used for estimating GHG emissions from manufacturing industries and construction

Emission factor for Fuel	CO_2 (kg CO2/TJ)	CH_4 (kg CH_4/TJ)	N_2O (kg N_2O/TJ)
Diesel	74100	3	0.6
Gasoline	69300	3	0.6
Kerosene	71900	3	0.6
LPG	63100	1	0.1

3.2.5.3. Description of any Flexibility Applied

Flexibility for time series which starts from year 1994 to 2023 is applied as described in Section 1.9.

3.2.5.4. Uncertainty assessment and time series consistency

Uncertainty assessment will be reported in Annex II: Uncertainty Assessment.

3.2.5.5. Category-specific QA/QC and verification

Compliant with QA/QC plan and implementation as outlined in Chapter 1, Section 1.5.

3.2.5.6. Category-specific recalculations

There are no recalculations for this category.

3.2.5.7. Category-specific planned improvements

This will be reported separately under the Inventory Improvement Plan section of the report.

3.2.6 Transport

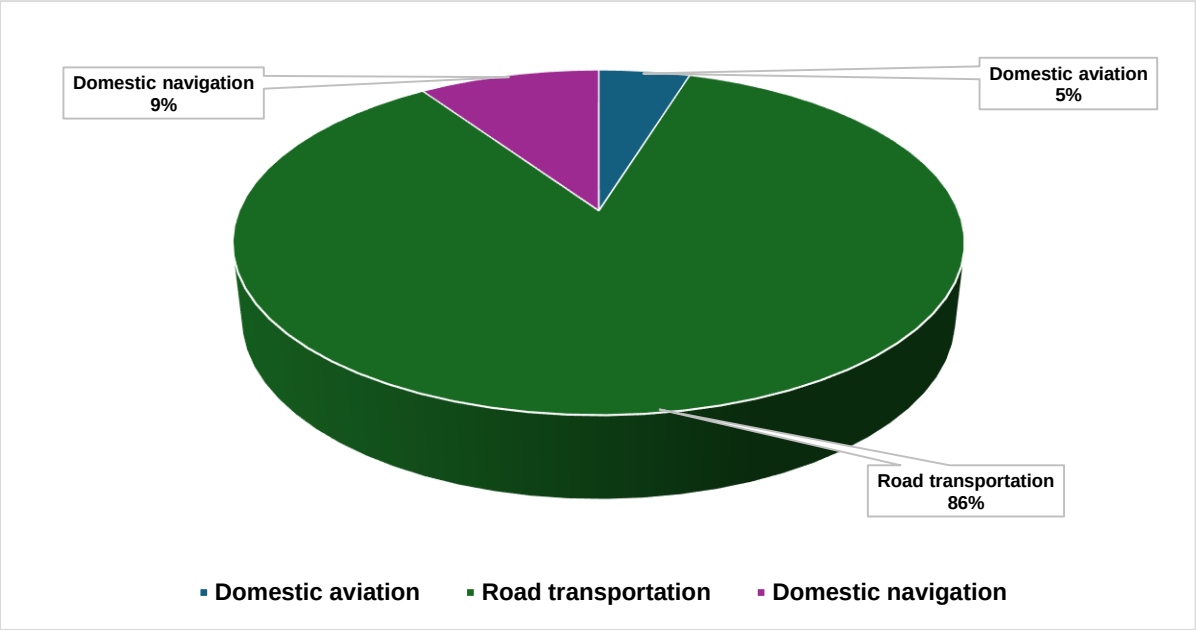
3.2.6.1 Category description

The transport sector is a predominant fossil fuel consuming sector in Vanuatu. In 2023, the GHG emissions from Transport sector were 91.49 Gg CO_2e, which is about 59.22% of the emissions within Energy sector and 18% of the total national GHG emissions (excluding removals). The transport sector includes the inland road transport, domestic aviation and domestic water borne navigation; the international aviation and international water borne navigation includes as the memo item and not part of this GHG inventory. The road transport sector accounted for 86% of the total GHG emissions from the transport sector, followed by water borne navigation (9%) and civil aviation (5%) as can be seen in table 3.10 and figure 3.2 below:

Table 3.11: Transport sector GHG emissions (Gg): 2023

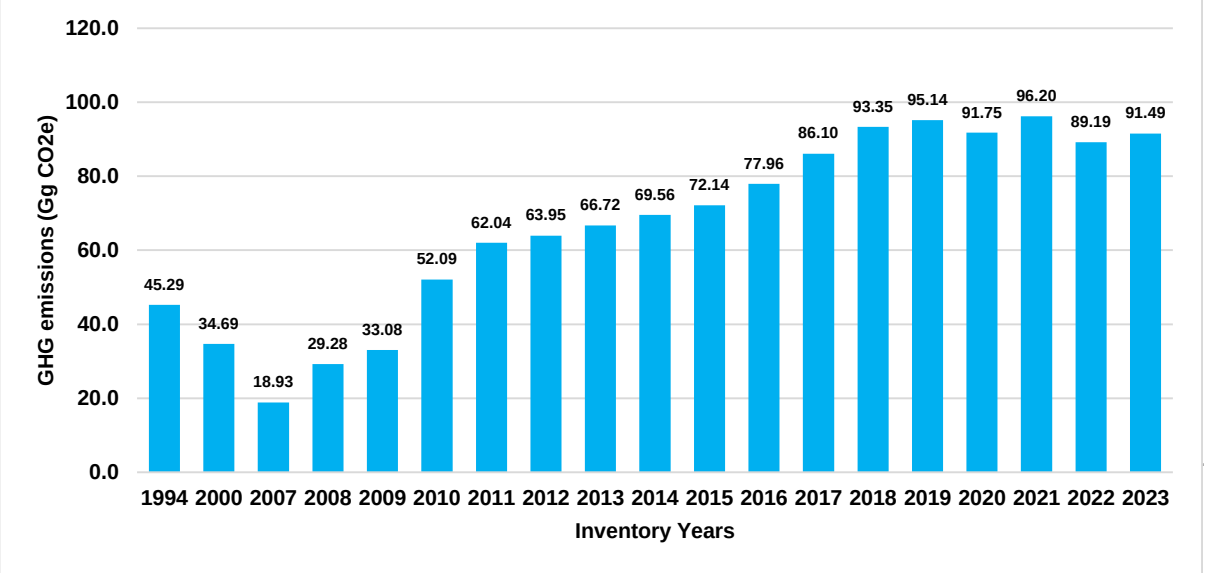
	Gg CO_2	Gg CH_4	Gg N_2O	Gg CO_2e
Domestic aviation	4.36	0.00	0.00	4.40
Road transportation	77.01	0.00	0.00	78.37
Domestic navigation	8.59	0.00	0.00	8.72
Total	**89.96**	**0.00**	**0.01**	**91.49**

Figure 3.3: Transport Sector GHG emissions: 2023



As can be seen in the figure 3.4 below, the transport sector emissions have increased by 102% from 1994 to 2023.

Figure 3.4: Total Transport Sector GHG emissions (Gg CO_2e): 1994-2023



Gasoline and Jet Kerosene consumption data for both the sectors is obtained. The emission estimates made for the combustion of Aviation Gasoline (AVG) and Jet Kerosene (DPK) in international aviation is reported separately as a memo item under international bunkers.

The Navigation sector emission estimates are based on fuel consumption (Gas / Diesel Oil, Gasoline/Petrol) segregated across national and international maritime fleets. Emissions estimates made for international fleets are reported as memo items under marine bunkers separately.

Table 3.12 presents the indirect gas (NOx, CO, NMVOC and SO_2) emissions from the transport sector.

Table 3.12: Transport sector indirect gas emissions (NOx, CO, NMVOC and SO_2) emissions (Gg): 2018-2023

Net indirect GHG emissions (Gg)	Gg NOx	Gg CO	Gg NMVOC	Gg SO_2
2018	0.51	0.71	0.12	0.05
2019	0.52	0.63	0.10	0.05
2020	0.48	0.62	0.09	0.04
2021	0.53	0.69	0.10	0.05
2022	0.51	0.69	0.10	0.05
2023	0.51	0.70	0.10	0.05

3.2.6.2 Methodological issues

The estimation of emissions from this category was also carried out using Tier 1 method, as outlined in 2006 IPCC guidelines. The Tier 1 approach calculates CO_2 emissions by multiplying estimated fuel sold/consumed with a default CO_2 emission factor.

The estimates of CO_2 emissions from each type of fuel used for transport was calculated using Equation 3.2.1 of the 2006 IPCC Guidelines, Vol. 2, Chapter 3, p. 3.12:

$$Emission = \sum_a Fuel\ Consumption_a \times Emission\ Factor_a$$

Where:

Emissions = emission in kg

EF_a = emission factor (kg/TJ)

$Fuel_a$ = fuel consumed, (TJ) (as represented by fuel sold)

a = fuel type a (e.g., diesel, gasoline, Aviation Gasoline, etc.)

For estimating CH_4 AND N_2O emissions for Tier 1 method for was calculated using equation 3.2.3 of the 2006 IPCC Guidelines, Vol. 2, Chapter 3, p. 3.13:

$$Emission = \sum_{a,b,c} Fuel\ Consumption_{a,b,c} \times Emission\ Factor_{a,b,c}$$

Since the IPCC guidelines do not provide EFs for indirect GHGs such as NOx, CO, NMVOCs and SO_2, but proposes the EMEP / EEA Guidebook (2023) default Tier 1 EFs for estimating these emissions.

Activity data

The total fuel consumption during the inventory year 2007-2023 from the transport sector are presented in the table below:

Table 3.13: Total Fuel Consumption in Transport Sector: 2007-2023

Sub-category	1.A.3.a Domestic Aviation		1.A.3.b Road Transportation			1.A.3.d Domestic Navigation			
Fuel consumption (Litres)	Aviation Gasoline (AVG)	Jet Kerosene (DPK)	Gas/Diesel Oil	Gasoline/Petrol	Kerosene	Gas/Diesel Oil	Gasoline/Petrol	Kerosene	Jet Kerosene (DPK)
2007	-	-	3836151	2342811	78000	1044609	55600	1840	-
2008	-	-	6084040	3788200	125600	1317388	91200	3220	-
2009	-	-	7081077	4474361	80200	1189329	81200	2000	-
2010	169264	1610965	11049674	6088825	8949	1203177	75600	1800	-
2011	306690	2503728	12903742	6895348	64300	1414006	65800	400	-
2012	371585	2780085	13009717	6913071	7350	1781039	29201	600	-
2013	575943	2646973	13719336	7109236	3800	1868095	34600	200	-
2014	463824	2889757	14260344	7108202	2400	2213760	61400	600	10800
2015	514444	2559194	15068310	7208200	1400	2518565	109900	-	200
2016	529079	2333135	16813388	7560430	400	2754394	206000	-	-
2017	643255	2623705	18458102	7766030	4200	3521900	269200	200	-
2018	544786	2889643	21241102	8108897	1600	2967481	272200	-	-
2019	533550	2992933	22010981	8099030	600	3045200	71800	-	400
2020	601430	2072405	21845641	8184990	600	2629635	44800	-	200
2021	429203	2142104	21997161	9373259	200	3206104	21600	-	-
2022	634735	1460437	19894859	9488482	200	3254282	20400	-	-
2023	571406	1198732	20586057	9860951	-	3240892	-	-	-

Emission Factor

The default emission factors used for estimating emissions from the fuels consumed for transportation is provided below in table.

Table 3.14: Emission Factors used for estimating GHG emissions from Transportation

Emission factor for Fuel	CO_2 (kg CO2/TJ)	CH_4 (kg CH_4/TJ)	N_2O (kg N_2O/TJ)
Gasoline	69300	3.8	5.7
Diesel	74100	3.9	3.9
Jet Kerosene	71500	0.5	2
Aviation Gasoline	70000	0.5	2

The EMEP / EEA Guidebook (2023) default Tier 1 EFs from the used for estimating indirect GHGs from Transportation Sub-sector are tabulated in the table.

Table 3.15: Emission Factors used for estimating indirect GHG emissions from Transportation

Emission factor for Fuel	NOx	CO	NMVOC	Units
Gas / Diesel Oil	12.96	3.33	0.7	g/kg
Gasoline/Petrol	8.73	84.7	10.05	g/kg
Aviation Gasoline	250	100	50	kg/TJ
Jet Kerosene	250	100	50	kg/TJ

3.2.6.3. Description of any Flexibility Applied

Flexibility for time series which starts from year 1994 to 2023 is applied as described in Section 1.9.

3.2.6.4. Uncertainty assessment and time series consistency

Uncertainty assessment will be reported in Annex II: Uncertainty Assessment.

3.2.6.5. Category-specific QA/QC and verification

Compliant with QA/QC plan and implementation as outlined in Chapter 1, Section 1.5.

3.2.6.6. Category-specific recalculations

There are no recalculations for this category.

3.2.6.7. Category-specific planned improvements

This will be reported separately under the Inventory Improvement Plan section of the report.

3.2.7 Other Sectors

3.2.7.1 Category description

Source category 1.A.4 other sectors is an aggregation of the Commercial/Institutional and Residential sources:

Commercial/Institutional includes a diverse category which includes direct emissions from hotels, tourism bungalow, guest houses, restaurants, retail, shopping complexes, government facilities, hotels, water utilities, accommodation, communications, business services, education, health and wholesale and retail trade, etc.

Whereas residential includes emissions from fuel combustion in households.

Fuels consumed are electricity (for lighting, heating, cooling, and pumping), liquefied petroleum gas (LPG; for cooking), kerosene (for lighting and cooking), diesel (for generating power for pumping and lighting), and charcoal, and fuel wood (for cooking).

This excludes the GHG emissions due to use of electricity which has been reported under 1A1a. The major fuels consumed in residential sector are firewood, LPG and kerosene.

In 2023, the Other sectors emitted 6.65 Gg of CO_2e, of which approximately 4.30% of total CO_2e emissions from the energy sector and 1.31% of total national GHG emissions (excluding removals). The biomass consumption in the residential sector (mainly from cooking) is mostly renewable biomass, collected from the forest land, in the absence of data emission form the biomass combustion not included in the national inventory report.

Furthermore, as can be seen in figure 3.5 below, the emissions from the Other sectors have increased by 27% from the base year 1994 to 2023.

Figure 3.5: Total Other Sector GHG emissions (Gg CO_2e): 1994-2023

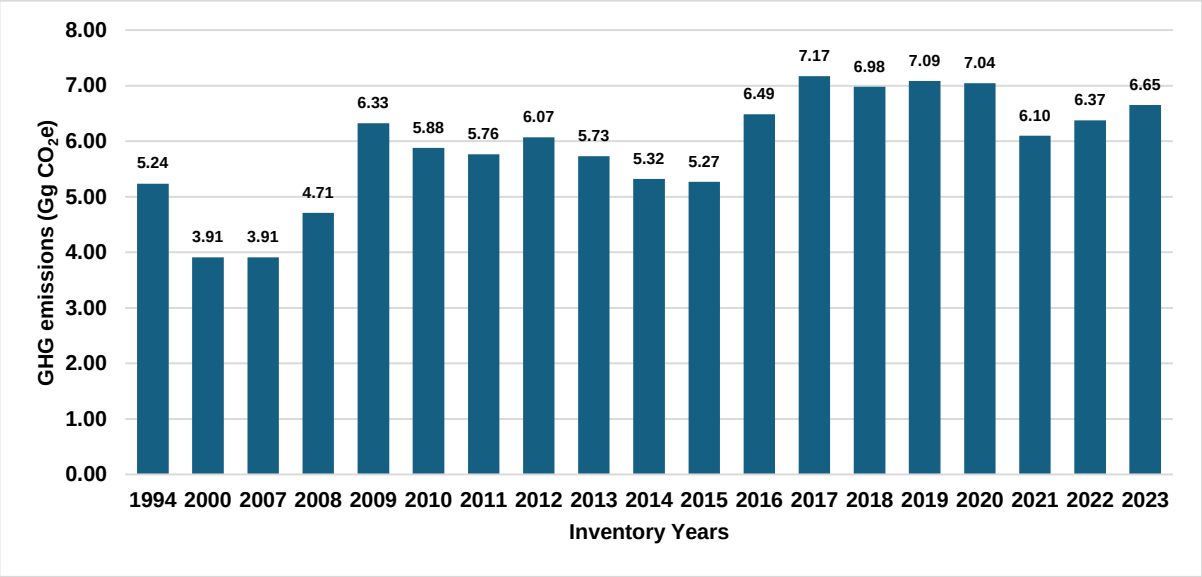


Table 3.16 presents the indirect gas (NOx, CO, NMVOC and SO2) emissions from the transport sector.

Table 3.16: Other sector indirect gas emissions (NOx, CO, NMVOC and SO_2) emissions (Gg)

Net indirect GHG emissions (Gg)	Gg NOx	Gg CO	Gg NMVOC	Gg SO_2
2018	0.09	0.05	0.02	0.03
2019	0.08	0.04	0.02	0.03
2020	0.06	0.03	0.02	0.02
2021	0.01	0.00	0.00	0.00
2022	0.01	0.00	0.00	0.00
2023	0.01	0.00	0.00	0.00

3.2.7.2 Methodological issues

For this category, the Tier 1 methodology of the 2006 IPCC Guidelines was used. The estimates of greenhouse gas emissions from each type of fuel used for manufacturing industries and construction were calculated using Equation 2.1 of the 2006 IPCC Guidelines, Vol. 2, Chapter 2, p. 2.11:

$$Emissions_{GHG} = \sum_{fuels} Emissions_{GHG,fuel} = \sum_{fuels} Fuel\ Consumption_{fuel} \times Emission\ Factor_{GHG,fuel}$$

Where:

$Emissions_{GHG,fuel}$= emissions of a given GHG by type of fuel (kg GHG)

$Fuel\ Consumption_{fuel}$ = amount of fuel combusted (TJ)

$Emission\ Factor_{GHG,fuel}$= default emission factor of a given GHG by type of fuel (kg gas/TJ).

Equation 2.2 of the 2006 IPCC Guidelines, Vol. 2, Chapter 2, page 2.11 was used to calculate total GHG emissions for all fuel types used:

$$Emissions_{GHG} = \sum_{fuels} Emissions_{GHG,fuel}$$

Since the IPCC guidelines do not provide EFs for indirect GHGs such as NOx, CO, NMVOCs and SO_2, but proposes the EMEP / EEA Guidebook (2023) default Tier 1 EFs for estimating these emissions.

Activity data

The total fuel consumption and emissions from the other sector during the inventory year 2023 are as follows:

Table 3.16: Total Fuel Consumption in Other- Commercial, Institutional and Residential Sector: 2007-2023

Fuel consumption	Other sectors			Commercial/Institutional				Residential
	Gas / Diesel Oil (Liters)	Gasoline/Petrol (Liters)	Kerosene (Liters)	Gasoline/Petrol	Kerosene	Gas / Diesel Oil	Liquefied Petroleum Gas (LPG) (tonnes)	Liquefied Petroleum Gas (LPG) (tonnes)
2007	742900	201800	76200	-	-	-	309	121
2008	640351	298200	111400	-	-	-	493	194
2009	687370	241200	64000	-	-	-	907	364
2010	499900	231600	20200	-	-	-	937	393
2011	435650	265000	25000	200	200		929	392
2012	552597	263800	21800	-	-	-	945	379
2013	486562	248200	13400	-	-	-	940	348
2014	382900	279600	9000	600	-	-	919	303
2015	-	-	-	242000	4000	441100	900	285
2016	608400	246014	2800	200			730	714
2017	665500	268800	1200	-	-	-	843	762
2018	457700	218200	600	-	-	-	881	881
2019	399100	211200	1200	-	-	-	927	927
2020	338400	141600	1200	-	-	-	974	974

2021	-	-	-	-	-	-	1020	1020
2022	-	-	-	-	-	-	1067	1067
2023	-	-	-	-	-	-	1113	1113

It is to be noted that Origin Energy is the leading LPG supplier in the country. While the exact breakdown of LPG distribution between commercial/institutional and residential sectors was unknown for the period 2018-2023 (breakdown of supply was not available during data collection), it's assumed that the supply is evenly divided between the two.

Emission Factor

The default emission factor of fuels used in Other sector is provided in the table below

Table 3.17: Emission Factors used for estimating GHG emissions from Other Sector-Commercial, Institutional and Residential

Emission factor for Fuel	CO2 (kg CO2/TJ)	CH4 (kg CO2/TJ)	N2O (kg CO2/TJ)
LPG	63100	1	0.1
Gas / Diesel Oil	74100	3	0.6
Gasoline/Petrol	69300	3	0.6
Kerosene	71900	3	0.6

3.2.7.3. Description of any Flexibility Applied

Flexibility for time series which starts from year 1994 to 2023 is applied as described in Section 1.9.

3.2.7.4. Uncertainty assessment and time series consistency

Uncertainty assessment will be reported in Annex II: Uncertainty Assessment.

3.2.7.5. Category-specific QA/QC and verification

Compliant with QA/QC plan and implementation as outlined in Chapter 1, Section 1.5.

3.2.7.6. Category-specific recalculations

There are no recalculations for this category.

3.2.7.7. Category-specific planned improvements

This will be reported separately under the Inventory Improvement Plan section of the report.

Chapter 4: Industrial processes and product use (CRT sector 2)

In Vanuatu, IPPU sector is non-existence in the absence of any major industry or industrial process emissions. Hence, GHG emissions from this sector considered as not occurring for the inventory years 2018-2023.

Chapter 5: Agriculture (CRT sector 3)

5.1 Overview of the sector

In Vanuatu, the agriculture sector is including emissions from agricultural activities, including livestock and manure management. It is the largest GHG emission sector in Vanuatu and the largest source of methane (CH_4) and nitrous oxide (N_2O). The emission sources comprise CH_4 from 3.A. Enteric Fermentation, CH_4 and N_2O from 3.B. Manure Management, Enteric fermentation was the main source of Agriculture emissions, contributing around 71 per cent of the sector's emissions in 2023. The next largest source was agricultural soils, followed by manure management (both direct and indirect N_2O emissions).

In 2023, the agriculture sector emissions were 328.40 Gg CO_2e which is about 64.69% of the total national GHG emissions (excluding removals). Of this CH_4 and N_2O emissions were 85.92% and 14.08% respectively. Methane (CH_4) emissions occur from this sector due to livestock rearing (enteric fermentation and manure management). N_2O is mainly emitted (direct and indirect) from manure management.

In 2023, Enteric fermentation was the main source of Agriculture emissions, contributing around 216.90 Gg CO_2e which is around 65% of the sector's emissions, followed by manure management remaining 111.50 Gg CO_2e (34%) of the sector's emissions. Moreover, the GHG emissions from agriculture sector shows decreasing trend due to decreased population of livestock over the period 2000-2023 (Emissions from this sector was not estimated for base year 1994. Hence, information on emissions is not available for 1994). The emissions have decreased by 44% from 2000-2023. The GHG emissions from sub-sectors of the agriculture sector are illustrated in the following figure 5.1 and 5.2.

Figure 5.1: Agriculture sector GHG emissions: 2023

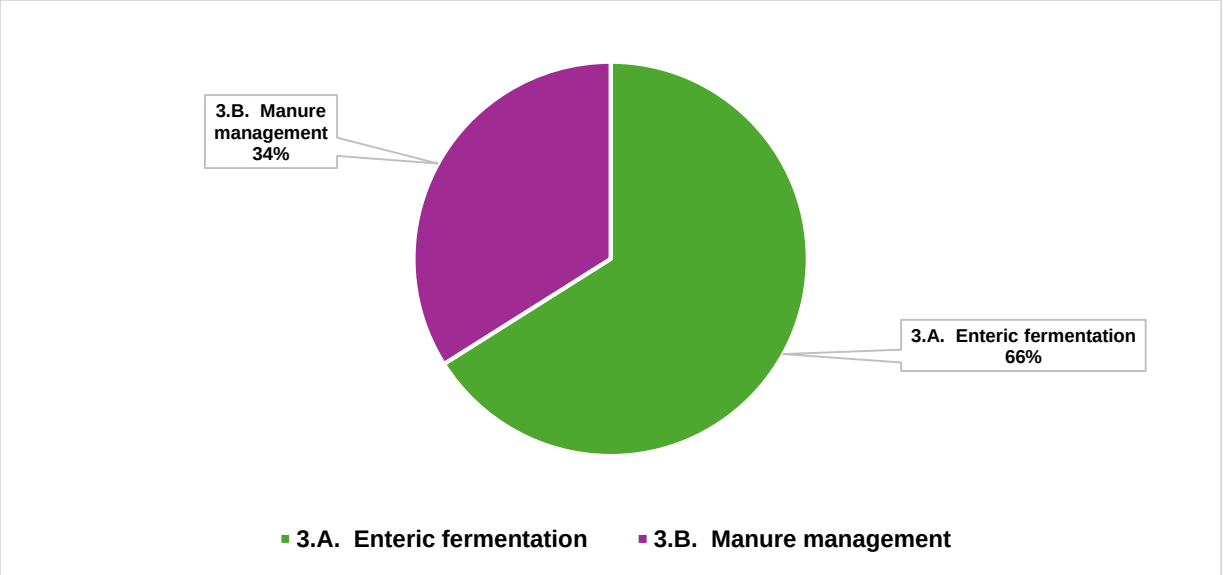
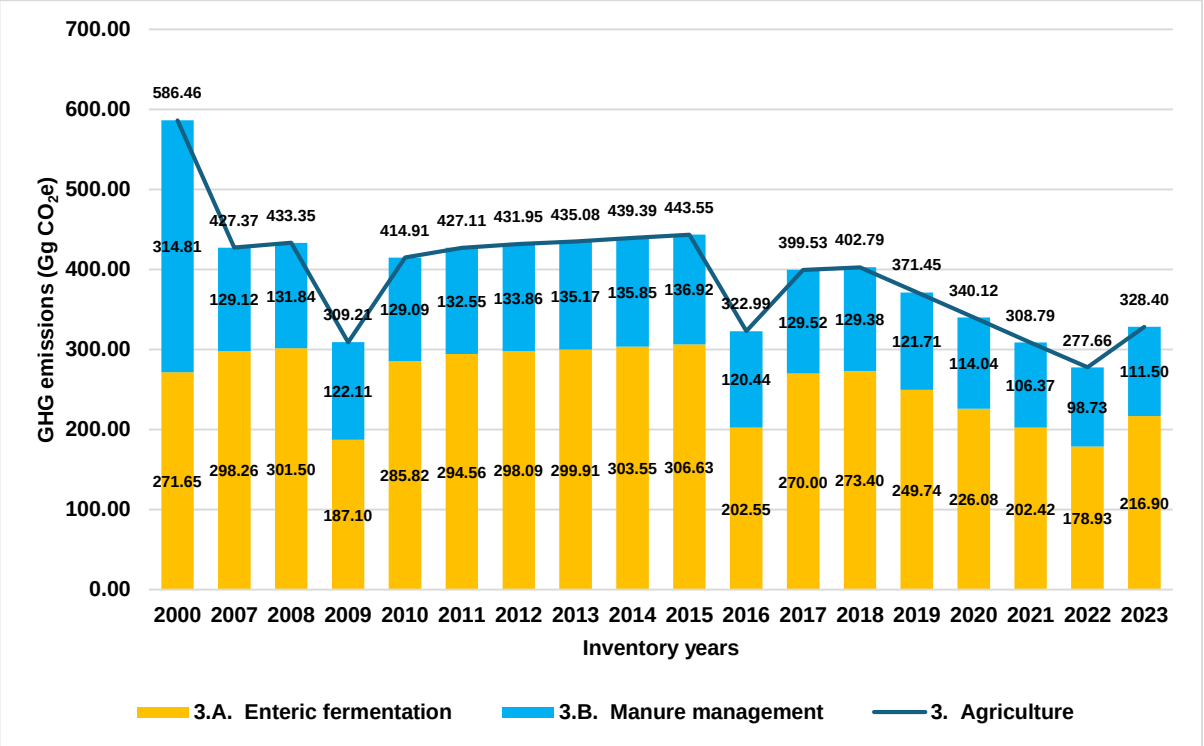


Figure 5.2: Agriculture sector GHG emissions (Gg CO_2e): 2000-2023



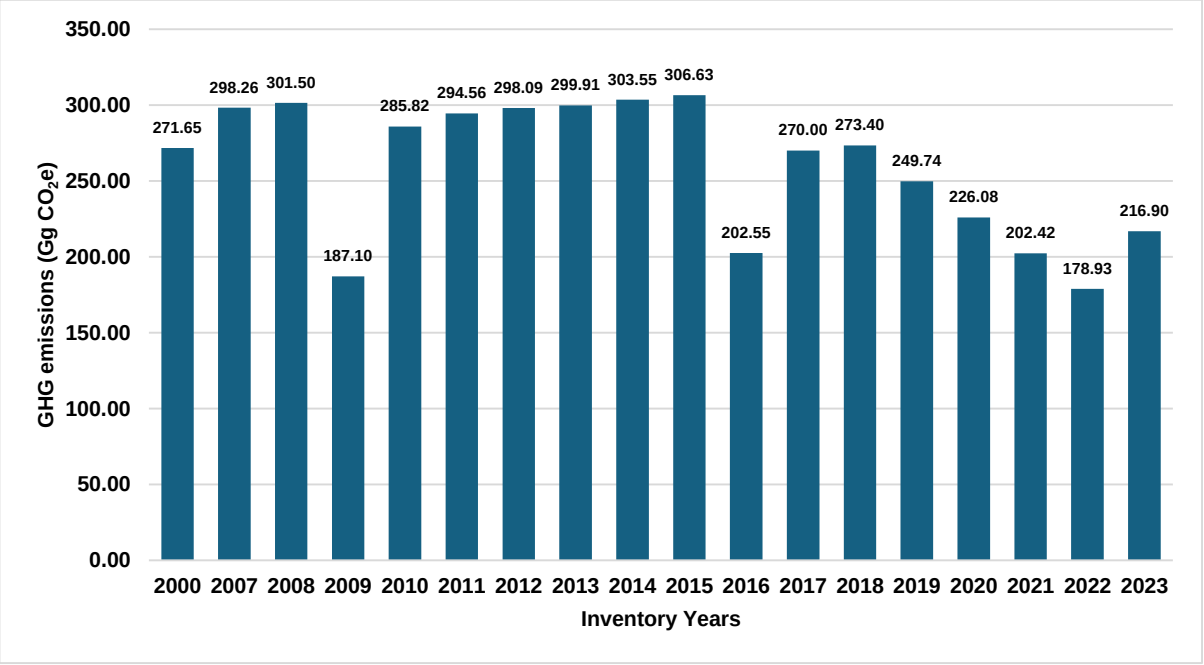
5.2 Enteric Fermentation (CRT category 3.A)

5.2.1 Category description

Methane is produced by 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 simple fatty acids, CO_2 and CH_4. The fatty acids are absorbed into the bloodstream, and the gases vented by eructation and exhalation by the animal. Unfermented feed and microbial cells pass to the intestines.

In Vanuatu, most cattle manure is managed as a solid on pastures and ranges, except dairy cows where there is some usage of lagoons. About half of the swine manure is managed in anaerobic lagoons. Total methane produced due to enteric fermentation was 7.75 Gg (viz 216.90 Gg CO_2e) in 2023. Furthermore as can be seen in figure 5.3 below, the enteric fermentation emissions have decreased by 20% over the period 2000-2023.

Figure 5.3: Total GHG emissions from Enteric Fermentation (Gg CO_2e): 2000-2023



5.2.2 Methodological issues

Emissions from enteric fermentation were calculated using IPCC Tier 1 methodology and default EFs.

Equations 10.19 and 10.20 were used to calculate methane emissions from enteric fermentation (pp. 10.28, Vol.4, Chapter 10 of the 2006 IPCC Guidelines).

$Emissions = EF_{(T)} \times \frac{N_{(T)}}{10^6}$ and

$CH_{Enteric} = \sum_i E_i$

Where:

$CH_{4Enteric}$ = total methane emissions from Enteric Fermentation, Gg CH4 yr-1

E_i= is the emissions for the i^{th} livestock categories and subcategories

$EF_{(T)}$ = emission factor for the defined livestock population, kg CH4 head-1 yr-1

$N_{(T)}$ = the number of head of livestock species / category T in the country

T = species/category of livestock

Activity data

The livestock population for year 2023 were estimated based on the in 2022 Vanuatu National Agriculture Census[8] using interpolation (for years 2018-2021) and extrapolation technique (for 2023). Cattle, Goats, Horses, Swine, Poultry are the category of livestock's existing in Vanuatu.

Table 5.1: Livestock population for estimating emissions from Enteric Fermentation (3A) and Manure Management (3B)

Inventory years	Cattle	Goats	Horses	Swine	Poultry	Sheep
2007	174152	8792	4000	86698	368251	
2008	175000	19500	4500	89000	804000	
2009	105051	34086	5559	108056	468779	
2010	165000	22000	6000	90000	600000	
2011	170000	24000	6000	92000	700000	
2012	172000	25000	6000	93000	700000	
2013	173000	25000	6200	94000	750000	
2014	175000	26000	6500	94000	800000	
2015	176674	26803	6778	94216	819000	
2016	115540	16288	7259	89903	514912	
2017	155473	23040	5897	93106	652457	
2018	157342	24198	6068	93729	680905	
2019	143963	19890	5110	90165	614525	
2020	130585	15582	4151	86601	548145	
2021	117206	11274	3193	83036	481765	
2022	103827	6966	2234	79472	415385	1260
2023	124905	15643	4545	85812	575683	1260

[8] 2022 Vanuatu National Agriculture Census https://vbos.gov.vu/2022-vanuatu-national-agriculture-census

Emission Factor

The default Tier 1 emission factors for calculating CH_4 emissions are provided in the 2006 IPCC Guidelines are tabulated in table below

Table 5.2: Emission Factors used for estimating CH_4 emissions from Enteric Fermentation

Species/Livestock category	Emission factor for Enteric Fermentation (kg head-1 yr-1)
Cattle	60
Goats	5
Sheep	5
Horses	18
Swine	1
Poultry	-

5.3 Manure Management (CRT category 3.B)

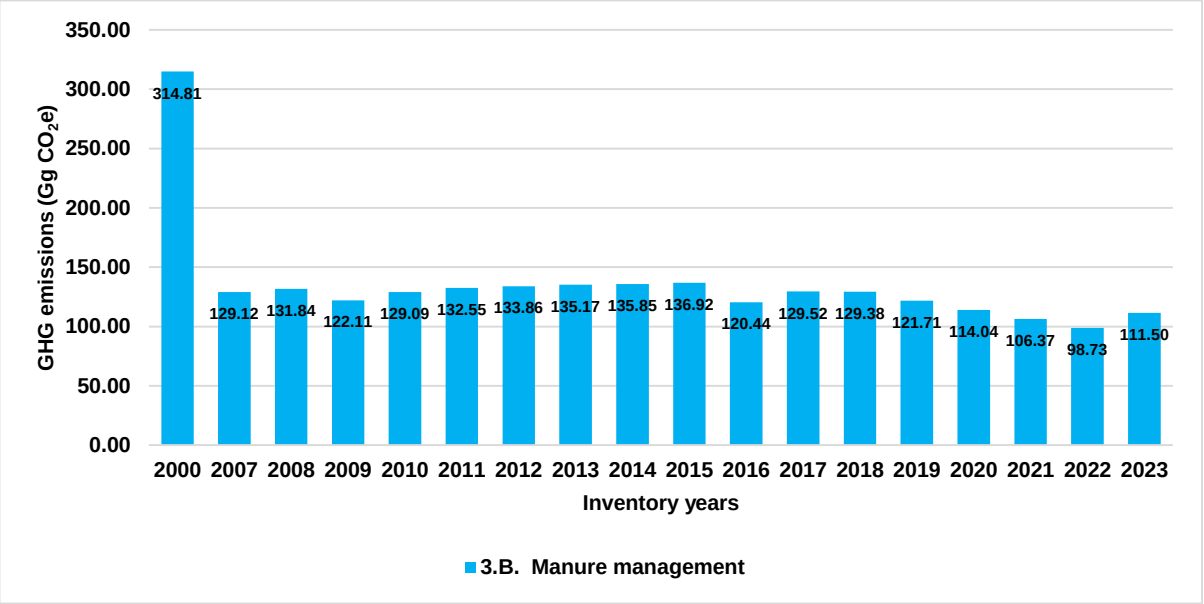
5.3.1 Category description

Methane is produced from the decomposition of organic matter remaining in manure under anaerobic conditions. These conditions occur when large numbers of animals are managed in a confined area, where manure is typically stored in large piles or lagoons.

Direct N_2O emissions from manure management systems (MMS) can occur via combined nitrification and denitrification of ammoniacal nitrogen contained in the wastes. The amount released depends on the systems and duration of waste management. Indirect N_2O emissions occur via runoff and leaching, and the atmospheric deposition of N volatilised from the MMS.

The manure management emitted 2.33 Gg of CH_4 and 0.17 Gg of N_2O in 2023. Furthermore, as can be seen in figure below, the GHG emissions from this category have decreased by 65% from 2000 to 2023.

Figure 5.4: Total GHG emissions from Manure Management (Gg CO_2e): 2000-2023



5.3.2 Methodological issues

Activity data is the same as used for enteric fermentation. CH_4 and N_2O emissions were estimated using Tier 1 approach. Total methane was estimated for a particular category of livestock by multiplying the manure management emission factor with total dung produced which is estimated by taking digestibility of the feeds into account. The IPCC 2006 default value for the region has been used for calculation.

CH_4 Emissions: The equation 10.22 was used to calculate methane emissions from manure fermentation (pp. 10.37, Vol.4, Chapter 10 of the 2006 IPCC Guidelines):

$$CH_{4\,Manure} = \sum_{(T)} \frac{EF_{(T)} \times N_{(T)}}{10^6}$$

Where:

$CH_{4Manure}$ = CH_4 emissions from manure management, for a defined population, Gg CH_4 yr-1

$EF_{(T)}$ = emission factor for the defined livestock population, kg CH_4 head-1 yr-1

$N_{(T)}$ = the number of head of livestock species/category T in the country

T = species/category of livestock

Direct N_2O Emissions:

The Tier 1 method entails multiplying the total amount of N excretion (from all livestock species/categories) in each type of manure management system by an emission factor for that type of manure management system. Emissions are then summed over all manure management systems. The Tier 1 method is applied using IPCC default N_2O emission factors, default nitrogen excretion data, and default manure management system data (see from

Annex 10A.2, Tables 10A-4 to 10A-8 for default management system allocations in Vol.4, Part 2, Chapter 10 of the 2006 IPCC Guidelines).

The equation 10.25 was used to calculate methane emissions from manure fermentation (pp. 10.54, Vol.4, Chapter 10 of the 2006 IPCC Guidelines):

$$N_2O_{D(mm)} = [\sum_S[\sum_T(N_T \times N_{ex\,T} \times MS_{T,S}) \times EF_{3(S)}] \times \frac{44}{28} \quad \textbf{(Equation 5.3)}$$

Where:

$N_2O_{D(mm)}$ = direct N_2O emissions from Manure Management in the country, kg N_2O yr-1

$N_{(T)}$ = number of head of livestock species/category T in the country

$N_{ex(T)}$ = annual average N excretion per head of species/category T in the country, kg N animal-1 yr-1

$MS_{(T,S)}$ = fraction of total annual nitrogen excretion for each livestock species/category T that is managed in manure management system S in the country, dimensionless

$EF_{3(S)}$ = emission factor for direct N_2O emissions from manure management system S in the country, kgN_2O-N/kg N in manure management system S

S = manure management system

T = species/category of livestock

44/28 = conversion of $(N_2O\text{-}N)_{(mm)}$ emissions to $N_2O_{(mm)}$ emissions

Indirect N_2O Emissions:

The Tier 1 calculation of N volatilisation in forms of NH3 and NOx from manure management systems is based on multiplication of the amount of nitrogen excreted (from all livestock categories) and managed in each manure management system by a fraction of volatilised nitrogen. N losses are then summed over all manure management systems. The Tier 1 method is applied using default nitrogen excretion data, default manure management system data (see Annex 10A.2, Tables 10A-4 to 10A-8 of the Vol.4, Chapter 10 of the 2006 IPCC Guidelines) and default fractions of N losses from manure management systems due to volatilisation (see Table 10.22):

The equation 10.26 was used to calculate indirect N_2O emissions from manure fermentation (pp. 10.54, Vol.4, Chapter 10 of the 2006 IPCC Guidelines):

$$N_{volatilization-MMS} = [\sum_S[\sum_T(N_T \times N_{ex\,T} \times MS_{T,S}) \times \frac{Frac_{GasMS}}{100}] (T,s)]]$$

Where:

$N_{volatilization\text{-}MMS}$ = amount of manure nitrogen that is lost due to volatilisation of NH_3 and NOx, kg N yr-1

$N_{(T)}$ = number of head of livestock species/category *T* in the country

$N_{ex(T)}$ = annual average N excretion per head of species/category *T* in the country, kg N animal-1 yr-1

$MS_{(T,S)}$ = fraction of total annual nitrogen excretion for each livestock species/category *T* that is managed in manure management system *S* in the country, dimensionless

$Frac_{GasMS}$ = percent of managed manure nitrogen for livestock category *T* that volatilises as NH_3 and Nox in the manure management system *S*, %

The indirect N2O emissions from volatilisation of N in forms of NH3 and NOx (N2OG(mm)) are estimated using Equation 10.27 of the Vol.4, Chapter 10 of the 2006 IPCC Guidelines:

$$N_2O_{G(mm)} = N_{volatilization-MMS} \times EF_4) \times \frac{44}{28}$$

Where:

$N_2O_{G(mm)}$ = indirect N_2O emissions due to volatilization of N from Manure Management in the country, kg N_2O yr-1

EF_4 = emission factor for N_2O emissions from atmospheric deposition of nitrogen on soils and water surfaces, kg N_2O-N (kg NH_3-N + NOx-N volatilised)$^{-1}$

Emission Factor

When using Tier 1 method, methane emission factors by livestock category or subcategory are used. The following table represents the CH_4 default emission factors for Manure Management by average annual temperature for each of the relevant livestock species.

Table 5.3: Emission Factors used for estimating CH_4, Direct and Indirect N_2O emissions from Manure Management

Species/Livestock category	Emission factor for Manure Management $EF_{(T)}$ kg CH4 head-1 yr-1	Emission factor for direct N2O-N emissions from MMS EF_3 kg N2O-N/kg N	Default N excretion rate $N_{rate(T)}$ kg N animal-1 yr-1	Fraction of managed livestock manure nitrogen that volatilizes Frac (GasMS)	Emission factor for N2O emissions from atmospheric deposition of nitrogen on soils and water surfaces (EF_4) kg N2O-N/(kg NH3-N + NOx-N volatilised)
Cattle	2	0.01	0.5	30%	0.01
Goats	0.17	0.01	1.42	12%	0.01
Sheep	0.15	0.01	1.13	12%	0.01
Horses	1.64	0.01	0.3	12%	0.01
Swine	24	0.01	0.46	48%	0.01

Poultry	0.02	0.01	0.82	12%	0.01

Chapter 6: Land use, land-use change and forestry (CRT sector 4)

6.1 Overview of the sector

In Vanuatu, GHG emissions/removals from Forest land has been covered. Vanuatu submitted its National REDD+ Forest Reference Level (FRL) in 2023. The accounting area of the FRL is the land area within the political borders recognized by Vanuatu and amounts to 1,289,000 ha. REDD+ is addressed at the national level by Vanuatu. The FRL study covered 13 major islands covering 89% of the total land area of Vanuatu and all of the forested area of Vanuatu. The total land area of Vanuatu is 123,667 ha of which 912,209 ha or 76% of land area is covered by natural forest[9]. Cropland represents the second largest land use with 156,812 ha or 13% of the national land area. Grasslands predominately occur on the islands Efate and Espiritu Santo and cover approximately 3% of the entire land cover of Vanuatu.

Deforestation: The Direct drivers of deforestation or forest degradation are human activities that directly impact forests and land, such as logging, agricultural expansion, or infrastructure and road development. Analysis of land use change between 2008 and 2017 indicates that forestland was lost as areas of Cropland, Grassland and settlement experienced high rates of expansion Cropland is the land use category with the highest growth in area of 15,689 ha over the 10-year Reference Period of FRL study. Settlements, followed by Grasslands, were other notable increases. Thus, conversion to Cropland accounted for 70% of forest loss, while conversion to Grasslands accounted for 11% and conversion to settlement accounted for 9% of forest loss between 2008-2018.

Table 6.1: Land use change (2008 – 2018)

Land use type	Area 2007 (ha)	Area 2018(ha)	Area change (ha)
Cropland	1,41,123	1,56,812	15,689
Forest	9,47,970	9,26,513	-21,457
Grassland	39,622	41,197	1,575
Other Land	75,733	76,491	758
Settlements	14,510	17,930	3,420
Water Body	3,706	3,720	14
Wetlands	1,003	1,003	1
Total	**12,23,667**	**12,23,667**	**-**

In 2023, the GHG emissions from this Land Use Change and Forestry (LUCF) sector was -14,819.62 Gg CO_2e. Under LUCF sector, CO_2 emissions/removals are estimated for changes

[9] The NFI Team defined forests as: Dense Forest: natural forests with canopy cover higher than 40%; Open Forest: natural forests with canopy cover 10-40%; Forest Plantations: Established Forest plantations with active management.

in forest and other woody biomass stock including commercial logging. Due to lack of data, emissions/removals from forest and grassland conversion, abandonment of managed lands and CO_2 emissions from soil have not been estimated.

6.2 Land-use definitions and the land representation approach(es) used and their correspondence to the land use, land-use change and forestry categories

National Forest definition

According to the National Forest Policy 2011-2020 and for REDD+ reporting purposes the following forest definition applies in Vanuatu:

“Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ.”

Classification of Forest Types: Land cover is represented by nine nationally defined land cover classes corresponding to each of the six broader IPCC land cover classes. The land cover class Forest land is represented in detail by four nationally defined land cover classes (dense and open forest, forest plantations and mangroves). Areas of mangroves and Forest Plantations are of such small scale in Vanuatu. Table 6.2 lists the national land cover classes and definitions compared to the IPCC categories

Table 6.2: Definition of IPCC Land-Use categories and national subdivisions adopted by Vanuatu.

IPCC land cover classes	VANRIS land cover types	Description
Forest	**Dense forest (DF)**	Natural forests with canopy cover higher than 40%
	Open forest (OF)	Natural forests with canopy cover 10-40%
	Forest Plantations	Established forest plantations with active management
	Mangroves	Natural forests dominated by mangrove species
Cropland	**Cultivated lands; annual crops and fallow**	Crops that are planted annually, including gardens
	Cultivated lands; perennial crops; coconut plantations	Perennial crops, including agroforestry systems
Grassland	**Grassland**	Grassland includes natural Grasslands and livestock pastures
Settlements	**Settlements**	Settlements and infrastructure
Waterbody	**Waterbody**	
Other	**Shrubs** **Bare soil** **No data**	

6.4 Forest Land (CRT category 4.A)

6.4.1 Forest Land Remaining Forest Land

6.4.1.1 Category Description

There are four broad sub-divisions to forest land remaining forest land: Dense Forest, Open Forest, Plantation Forest and Mangroves.

The GHG emissions from forest land in 2023 was -14088.79 Gg CO_2e as presented in the table 6.3 below:

Table 6.3: Forest Land Remaining Forest Land: CO_2 emissions (Gg CO_2e): 2007-2023

Inventory years	Annual increase in biomass carbon stocks due to biomass growth	Annual carbon loss due to biomass removals	Net Annual Carbon Uptake (+) or Release (-)	Convert to CO_2 Annual Emission (-) or Removal (+)
	(tonnes C yr^{-1})	(tonnes C yr^{-1})	(tonnes C yr^{-1})	(Gg CO_2)
2007-2009	2109800	194938	1914862	–7021.15
2010-2015	2109800	207885	1901915	–6973.68
2016-2017	Not estimated			
2018	4083714	189442	3894272	-14279.00
2019	4073347	189442	3883906	-14240.99
2020	4062970	189442	3873529	-14202.94
2021	4052594	189442	3863152	-14164.89
2022	4042217	189442	3852775	-14126.84
2023	4031840	189442	3842399	–14088.79

6.4.1.2 Methodological issues

The methodology for estimating changes in forest biomass carbon and calculating CO_2 removals in the Forest Land Remaining Forest Land category were conducted in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories using the biomass Gain-Loss Method i.e., Equation 2.7 (pp. 2.12, Vol 4, Chapter 2 of the 2006 IPCC Guidelines) with and default factors. Average annual above-ground biomass growth (GW) was from the table 4.12 of Chapter 4, Volume 4 of the 2006 IPCC Guidelines. The values of Ratio of below-ground biomass to above-ground biomass is taken from the FRL report for the Dense and Open Forest while for Plantation Forest and Mangroves are taken the table 4.12 of Chapter 4, Volume 4 of 2006 IPCC Guidelines.

Woody biomass carbon losses due to removals are estimated using Equations 2.11-2.13 of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Emissions from Disturbances were not estimated due to lack of data.

Conversion of stored carbon to CO_2e units was performed by multiplying by the conversion factor (-44/12).

Since Tier 1 methodology was used, in carbon stock changes in dead organic matter and Soil organic carbon were not estimated.

Activity data

The activity data i.e. the forest land remaining forest land area for the period 2018 to 2023 were estimated using the Land use in Vanuatu in the year 2018 and Forest cover land use

change statistics as reported in the Vanuatu's National REDD+ Forest Reference Level (Modified Submission for UNFCCC Technical Assessment in 2023) and presented in below tables 6.4.

Table 6.4: Area of Forest land remaining forest land (2018-2023) (ha)

Forest Land remaining Forest Land estimation (ha)							
Year	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**Change in Area (avg. ha per year)**
Dense Forest (DF)	795,384	794,279	793,174	792,069	790,964	789,859	1105
Open Forest (OF)	122,367	121,088	119,809	118,530	117,251	115,972	1279
Plantation Forest	8,037	8,038	8,038	8,038	8,038	8,038	0
Mangroves	725	725	725	725	725	725	0
Forest Land (ha)	926,513	924,130	921,746	919,362	916,978	914,594	2384

Emission Factor

The Conversion factors for biomass increment and losses in Forest Land remaining Forest land used in calculations are presented in below table.

Table 6.5: Conversion factors for biomass increment and losses in Forest Land remaining Forest land

	Dense Forest	Open Forest	Plantation Forest	Mangroves	Source
Average annual above-ground biomass growth (tonnes dm ha-1 yr-1) (G_W)	7	7	15	9.9	Table 4.12, Ch4, Volume 4 of 2006 IPCC guidelines
Ratio of below-ground biomass to above-ground biomass [tonnes bg dm (tonne ag dm)-1] ®	0.323	0.323	0.49	0.49	FRL and Table 4.4, Ch4, Volume 4 of 2006 IPCC guidelines
Carbon fraction of dry matter (CF)	0.47	0.47	0.47	0.47	FRL
Biomass conversion and expansion factor for conversion of removals in merchantable volume to total biomass removals (including bark) [tonnes of biomass removals (m3 of removals) –1] ($BCEF_R$)	1.89				Table 4.5, Ch4, Volume 4 of 2006 IPCC guidelines
Basic wood density	0.5				Tables 4.13 and 4.14, Ch4, Volume 4 of 2006 IPCC guidelines

Chapter 7: Waste (CRT sector 5)

7.1 Overview of the sector

In Vanuatu, the waste sector covers methane (CH_4) and nitrous oxide (N_2O) from the following key categories:

- 5.A. Solid waste disposal
- 5.D. Wastewater treatment and discharge (mainly Domestic wastewater handling since there is no industrial wastewater generation)

The GHG emissions from the category Biological treatment of solid waste (5B) and Incineration and open burning of waste (5C) are not estimated in this inventory due to absence of data.

The majority of emissions within the waste sector are from solid waste disposal, followed by wastewater treatment and discharge. In 2023, GHG emissions in the Waste sector amounted to 24.77 Gg CO_2e viz about 4.88% of the total national GHG emissions. The GHG emissions from Solid waste disposal emissions is about 16.47 Gg CO_2e (66.50% of the sector) are wastewater treatment and discharge emissions are Gg CO_2e (33.50% of the sector).

Figure 7.1: Waste sector GHG emissions: 2023

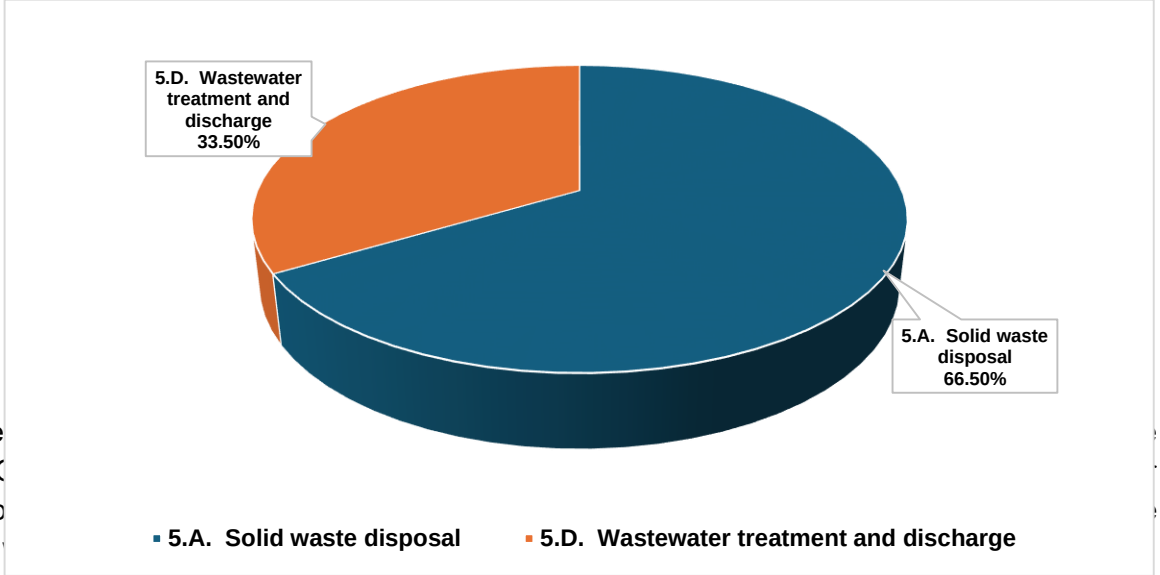


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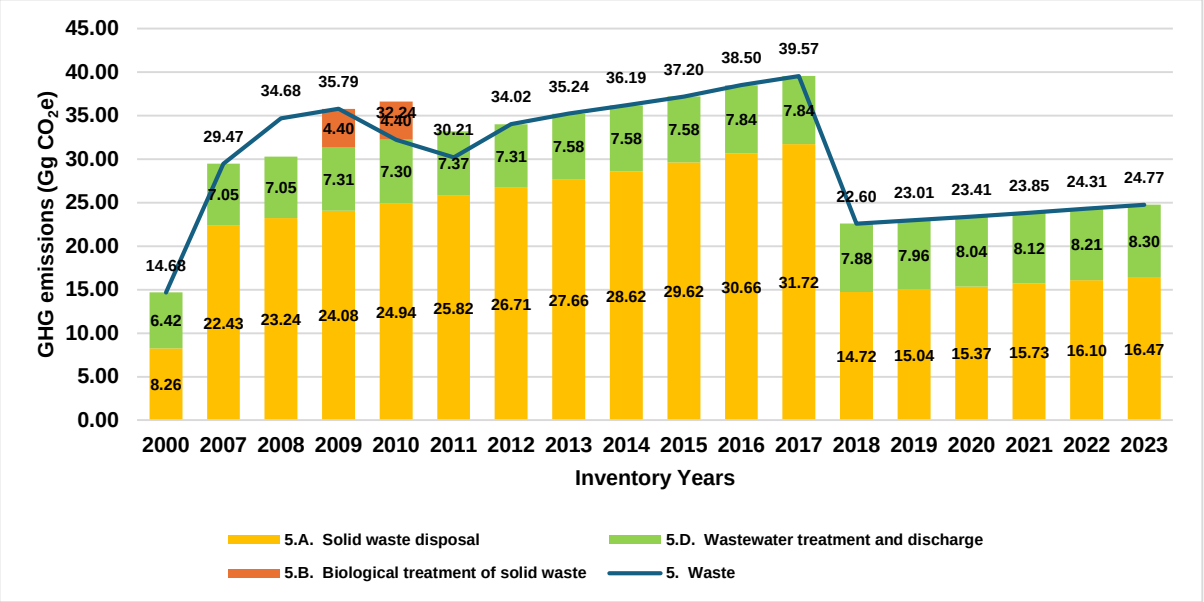
Table 7.1: Waste Sector GHG Emissions (Gg): 2023

Category	CH_4 (Gg)	N_2O (Gg)	Total GHG Emissions (Gg CO_2e)
5. Waste	**0.75**	**0.01**	**24.77**
5.A. Solid waste disposal	**0.59**	-	16.47
5.D. Wastewater treatment and discharge	0.16	0.01	8.30

As can be seen below in figure 7.2, the GHG emissions from the waste sector show an increasing trend over the period 2000 to 2023. Moreover, it has increased by 69% during the period 2000 to 2023.

Figure 7.2: Waste sector GHG emissions: 2000-2023



7.2 Solid Waste Disposal (CRT category 5.A)

7.2.1 Category description

Vanuatu is one of fifteen Pacific Island Nations which took part in the PacWastePlus Programme implemented through Secretariat of the Pacific Regional Environment Programme (SPREP) and funded by the European Union Delegation of the Pacific. Waste data collation, analysis and reporting for the Vanuatu National Waste Audit Analysis Report[10] was guided by the overarching Regional Waste Data Collection, Monitoring, and Reporting (DCMR) Framework for the Pacific Island Countries and Territories (PICT).

Vanuatu's overall waste management practices are limited and primarily rely on burying, burning, dumping, and landfilling. There is limited access to proper waste collection and disposal facilities, leading to environmental degradation and health hazards. The country requires investment in infrastructure, implementation of data-guided decision making, and increased general waste management education to improve the current situation.

Landfills in Vanuatu

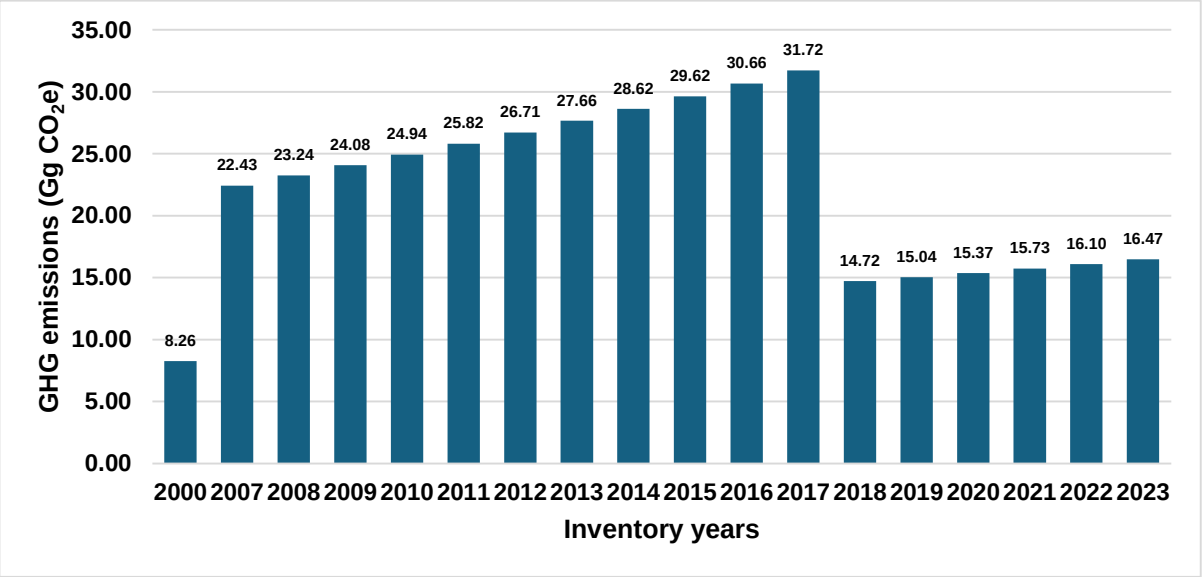
Once collected, solid waste is taken to a landfill or a controlled disposal site. There are three waste disposal sites in Vanuatu, Bouffa landfill (Port Vila City Council), Luganville dumpsite (Luganville Municipal Council) and Lenakel dumpsite (Lenakel Town Municipal Council). In

[10] Vanuatu MSW Composition from Vanuatu National Waste Audit Analysis Report (August 2023), Authors: PacWastePlus and MRA https://pacwasteplus.org/resources/vanuatu-national-waste-audit-analysis-report/

other Provincial centres, waste is disposed of openly at an assigned area. Besides the formal disposal, backyard disposal is also still in practice in most homes throughout Vanuatu (DEPC, 2016)[11]. Backyard waste is either buried or burnt. Bouffa landfill on Efate is the only managed landfill in Vanuatu.

In 2023, the GHG emissions was about 16.47 Gg CO_2e which is 84.26% of the sectoral emissions. Moreover, the emissions have decreased by 99.43% during the period 2000 to 2023. The table 7.2 below presents the emissions from this category for the period 2000 to 2023.

Table 7.2: Waste Sector GHG Emissions (Gg): 2000- 2023



7.2.2 Methodological issues

The IPCC Tier 1 First Order Decay (FOD) model has been applied for calculation of methane emission from landfill sites. In a FOD model, the decay rate of carbon in the waste is governed by a first order reaction. Thus, the rate of decay is directly proportional to the amount of carbon remaining in the disposal site. This model is built on an exponential factor that describes the fraction of degradable material which each year is degraded into CH_4 and CO_2. One key input in the model is the amount of degradable organic matter in the waste disposed at the solid waste disposal site. Degradable Organic Carbon (DOC) is the organic carbon in the waste that is amenable to biochemical decomposition. The basis for the calculation is the amount of Decomposable Degradable Organic Carbon (part of the organic carbon that will be degradable under an anaerobic condition) at the disposal site of solid waste after initial decomposition under aerobic condition. The spreadsheet model estimates the amount of decomposable DOC in the disposal site, taking into account of the amount deposited each year and the amount.

The equations 7.1 to 7.3 as outlined below are used for First order of decay (FOD) method estimate for solid waste sent to landfill as provided in the 2006 IPCC Guidelines and IPCC

[11] DEPC, 2016. National Waste Management, Pollution Control Strategy and Implementation Plan 2016-2020. Republic of Vanuatu.

Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (2000) are given below:

CH_4 emissions- FOD equation

$$CH_4\ emissions\ =\ \{\sum_x [MSW_x \times L_o(x) \times ((1 - e^{-k}) \times e^{-k(t-x)})] - R(t)\} \times (1 - OX)$$

(Equation 7.1)

Where:

CH_4 emissions = Total CH_4 emissions in tonnes

x = Landfill opening year or earliest year of historical data available

t = Inventory year

MSW_x = Total municipal solid waste disposed at SWDS in year x in tonnes

R = Methane collected and removed (ton) in inventory year

L_0= Methane generation potential

K = Methane generation rate constant, which is related to the time taken for the DOC in waste to decay to half its initial mass (the "half-life"); User Input or consult default value of 2006 IPCC guidelines

OX = Oxidation factor

Methane generation potential (L_0)

$$L_0\ =\ MCF \times DOC \times DOCf \times F \times \frac{16}{12}$$

(Equation 7.2)

Where:

MCF = Methane Correction Factor

DOC = Degradable Organic Content

DOC_f = Fraction of DOC that is ultimately degraded

Degradable organic carbon (DOC)

$$DOC\ =\ (0.4 \times A) + (0.17 \times B) + (0.15 \times C) + (0.3 \times D)$$

(Equation 7.3)

Where:

A = Fraction of MSW that is paper and textiles

B = Fraction of MSW that is garden waste, park waste or other non-food organic putrescibles

C = Fraction of MSW that is food waste

D = Fraction of MSW that is wood or straw

Activity data

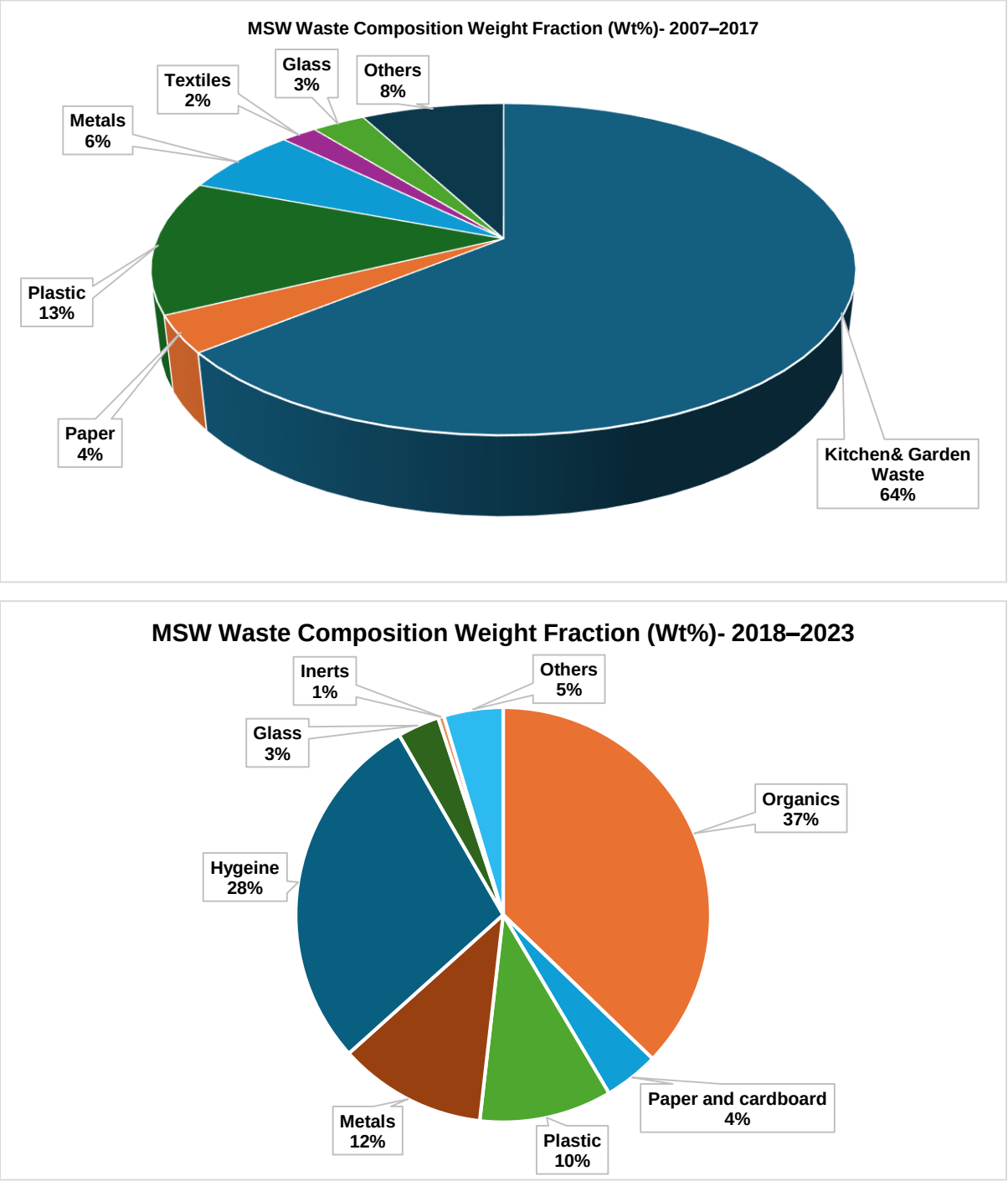
In the absence of actual monitored data, the MSW generation in Vanuatu has been estimated from the total population of the country and using per capita waste generation rate of 89.1 (kg/capita/year) from the Vanuatu National Waste Audit Analysis Report for the years 2018-2023. The total human population data for 2018 & 2019 were estimated based on the interpolation technique from previous census. While for year 2021-2023, were estimated using current population growth rate of 1.4% for Urban areas and 2.6% for Rural areas as per the Vanuatu 2020 National Population and Housing Census The activity data used for estimating GHG emissions are presented in table 7.2.

Table 7.2: Activity data for solid waste disposal: 2007-2023

Population	Urban Population	Rural Population	Total Population	Total Solid Waste (MSW) generate (Tonnes)	Waste disposed at managed sites (landfill) (Tonnes)	Waste disposed at un-managed sites (landfill, open dumping) (Tonnes)	No of landfill	Uncontrolled waste dumps
2007	53261	170172	223433	31099	0	31099	3	3
2008	55193	173468	228661	32226	0	32226	3	3
2009	57195	176828	234023	33394	0	33394	3	3
2010	59196	180187	239383	34564	0	34564	3	3
2011	61267	183610	244877	35774	0	35774	3	3
2012	63411	187098	250509	37027	0	37027	3	3
2013	65630	190652	256282	38324	0	38324	3	3
2014	67927	194274	262201	39666	0	39666	3	3
2015	70304	197965	268269	41055	0	41055	3	3
2016	72764	201726	274490	42493	0	42493	3	3
2017	75310	205558	280868	43981	0	43981	3	3
2018	72458	214794	287252	25594	0	25594	3	3
2019	69606	224030	293636	26163	0	26163	3	3
2020	66753	233266	300019	26732	0	26732	3	3
2021	67688	239331	307019	27355	0	27355	3	3
2022	68636	245554	314190	27994	0	27994	3	3
2023	69597	251938	321535	28649	0	28649	3	3

The MSW composition is also taken from the Vanuatu National Waste Audit Analysis Report for the years 2018-2023 and presented in the figure below:

Figure 7.2: MSW Characterization (wt%) –Vanuatu National Waste Audit Analysis Report (2007-2017 & 2018-2023)



Emission factor

Methane conversion factor (MCF) by landfill type, degradable organic carbon (DOC), degradable organic carbon fraction (DOC_f), and some other parameters were assumed by default due to the lack of national data.

The default values used for MSW were taken from the 2006 IPCC Guidelines.

Table 7.3: Default factors used in calculations of methane emissions from MSW landfills

Parameter	Value	Source
Methane correction factor (MCF)-Unmanaged 4 – shallow (<5 m waste)	0.4	IPCC default
Degradable organic carbon (DOC)	0.128	Calculated
Fraction of DOC that is ultimately degraded (DOCf)	0.6	IPCC default
Fraction of methane in landfill gas (F)	0.5	IPCC default range (0.4-0.5) 0.5 is considered
Oxidation Factor	0	IPCC default
Methane generation rate constant (k) **Tropical (MAT > 20°C)** **Dry (MAP < 1000 mm)**	11	IPCC default
Methane Recovery (R)	0	IPCC default

7.3 Wastewater Treatment and Discharge (CRT category 5.D)

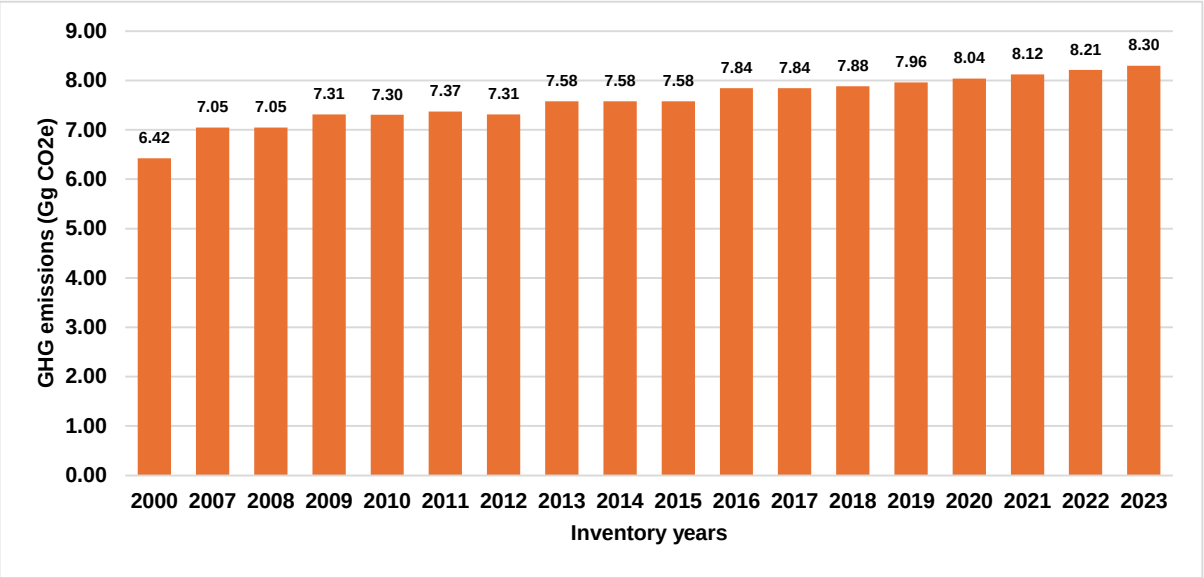
7.3.1 Category description

The anaerobic decomposition of organic matter in wastewater results in emissions of methane while chemical processes of nitrification and denitrification in wastewater treatment plants and discharge waters give rise to emissions of nitrous oxide.

In Vanuatu, the wastewater generation form commercial activity is very limited and almost negligible/zero wastewater generation form industrial activity; hence main source of wastewater is domestic source. Methane is emitted from wastewater when it is handled anaerobically. The effluents may be treated on site (uncollected) and finally disposed of untreated/partially or fully treated into nearby environment (surface waters and marine disposals). Emissions from domestic wastewater handling are estimated for both urban and rural centres.

In 2023, the Wastewater treatment and discharge category accounts for 8.30 Gg CO_2e viz 33% of the sectoral emissions. Of which CH_4 (0.16 Gg) and N_2O (0.015 Gg) emissions are 53% and 47% respectively. Moreover, the GHG emissions from this category has increased by 29% during 2000 to 2023.

Figure 7.2: Wastewater treatment and discharge GHG emissions (Gg CO_2e): 2000-2023



7.3.2 Methodological issues

In this inventory, CH_4 emissions and indirect N_2O emissions from human wastewater were determined for the entire population of the country. CH_4 emissions from domestic wastewater, as well as N_2O emissions from human activity were estimated in accordance with the Tier 1 2006 IPCC Guidelines and default factors.

Total methane emissions from domestic wastewater were calculated using Equation 6.1-6.3 (pp. 6.11-6.13) of Vol. 5, Chapter 6 of the 2006 IPCC guidelines. These equations are also provided below.

It was assumed that the amount of organic component extracted as sludge in the accounting year S=0 (BOD kg/year) since there is no information on the collection of sludge. Also, due to the lack of practice of methane recovery from wastewater in the country, the amount of recovered methane in the reference year was assumed to be R=0 (kg/year).

While for estimating indirect nitrous oxides from treated wastewater discharges into the aquatic environment, equation 6.3 (pp. 6.13) of the Vol 5, Chapter 6 of the 2006 IPCC Guidelines was used and presented below (equation 7.6).

Equation for Total CH_4 emissions

$$CH_4\ emissions\ = \left[\sum_{i,j}(U_i \times T_{i,j} \times EF_j)\right] \times (TOW - S) - R \qquad \textbf{(Equation 7.4)}$$

Where:

CH4 Emissions = CH4 emissions in inventory year, kg CH4/yr

TOW = total organics in wastewater in inventory year, kg BOD/yr

S = organic component removed as sludge in inventory year, kg BOD/yr

U_i = fraction of population in income group i in inventory year, See Table 6.5.

$T_{i,j}$ = degree of utilisation of treatment/discharge pathway or system, j, for each income group

fraction i in inventory year,

i = income group: rural, urban high income and urban low income

j = each treatment/discharge pathway or system

EF_j =emission factor, kg CH4 / kg BOD

R = amount of CH4 recovered in inventory year, kg CH4/yr

Equation for Emission factor (EF_j)

$$EF_j = Bo \times MCF_j \quad \textbf{(Equation 7.5)}$$

Where:

EFj = emission factor, kg CH4/kg BOD

j = each treatment/discharge pathway or system

Bo = maximum CH4 producing capacity, kg CH4/kg BOD

MCFj = methane correction factor (fraction)

Equation for Total organically degradable material in domestic wastewater

$$TOW = P \times BOD \times 0.001 \times I \times 365 \quad \textbf{(Equation 6.6)}$$

Where:

TOW = total organics in wastewater in inventory year, kg BOD/yr

P = country population in inventory year, (person)

BOD = country-specific per capita BOD in inventory year, g/person/day

0.001 = conversion from grams BOD to kg BOD

I = correction factor for additional industrial BOD discharged into sewers

Activity data

To calculate CH_4 and N_2O emissions from domestic and commercial wastewater treatment and handling, the human population data for 2018 & 2019 were estimated based on the interpolation technique from previous census. While for year 2021-2023, were estimated using current population growth rate of 1.4% for Urban areas and 2.6% for Rural areas as per the Vanuatu 2020 National Population and Housing Census[12]. The estimated total human population for the year 2023 was 321,535.

Emission factor

[12] Vanuatu 2020 National Population and Housing Census https://vbos.gov.vu/sites/default/files/2020_Vanuatu_National_Population_and_Housing_Census_-_Analytical_report_Volume_2.pdf

The emission factor and other factors which were used to calculate CH_4 emissions are presented in the table below.

Table 7.4: Emission Factor and other factors used for estimating CH_4 from Wastewater treatment and discharge

Parameter	Value	Source
Correction factor for additional industrial BOD discharged into sewers (I)	1.25	Default value 1.25 for collected wastewater
Maximum CH_4 producing capacity, kg CH4/kg BOD (B_o)	0.60	Default value (0.6 kg CH4/kg BOD; 0.25 kg CH4/kg COD)
Methane correction factor (fraction) (MCF_i)	0.10	IPCC default value for Untreated system - Sea, river and lake discharge
Fraction of population in income group i in inventory year (U_i)	0.23	Sectoral expert judgement
Degree of utilization (ratio) of treatment/discharge pathway or system, j, for each income group fraction i in inventory year ($T_{i,j}$)	0.48	Sectoral expert judgement
Organic component removed as sludge in inventory year, S_i	0	
Amount of CH_4 recovered in inventory year, R_i	0	

The emission factor and other factors that were used to calculate N_2O emissions are presented in table 7.5 below.

Table 7.5: Emission Factor and other factors used for estimating N_2O from Wastewater treatment and discharge

Parameter	Value	Source
Fraction of nitrogen in protein	0.16	IPCC default
Fraction of non-consumed protein, $F_{NON-CON}$	1.4	IPCC default
Fraction of industrial and commercial co-discharged protein into sewer system, $F_{IND-COM}$	1.25	IPCC default
Nitrogen removed with sludge (kgN.yr), N_{sludge}	0	IPCC default
Emission factor for N_2O emissions from discharged to wastewater in kg N_2O-N per kg N_2O	0.005	IPCC default
Emissions from wastewater treatment plants	0	IPCC default
Per capita protein consumption (kg/person/year)	22.805	

National Inventory improvement plan

The improvement of the GHG inventory system follows a step wise approach. The institutional arrangement and the activity data collection, analysis and archiving system for GHG inventory is consistently being reviewed and improved. Efforts would be concentrated on improving the disaggregation and completeness of the activity data according to the 2006 IPCC Guidelines and developing country specific emission factors for key categories for the next inventory cycle.

Identified gaps	Improvement actions
Energy Sector	
Sectoral consumption is estimated based on the assumptions.	• Collect data on fuel consumption for activities in for all manufacturing and construction, transport activities specified by sub-categories, commercial and institutional buildings, residential for the entire time series. • Implement an MRV system to continuously collect data from fuel suppliers on fuel sold to end-users. • Establish mechanisms to strengthen and improve collaboration between the relevant stakeholders on data and information sharing, including capacity building.
Statistics on the combustion of fuelwood are not available.	Assess the possibilities to improve statistics on fuelwood combustion, specially at households, to improve the estimates in category 1A4 of the inventory.
Industrial Processes and Product Use (IPPU) Sector	
Emissions from the use of HFCs and PFCs gases are estimated based on assumptions.	Collect data on total HFC and PFC imports and split between application area such as refrigeration and air conditioning, foam blowing and fire protection for the entire time series.
Agriculture, Forestry, and Other Land Use (AFOLU) Sector	
Livestock census not conducted regularly.	Livestock census will be conducted on regular basis or mechanism for collecting data on livestock population on regular basis will be developed.
Lack of information on N fraction in different Manure management systems (MMS)	Collect information on N fractions managed in different MMS
Land-use change data estimated using assumptions.	• Regular (annual basis) assessment of the land use based on satellite imagery will be done for various land use types, land management practices and inputs. • Improve data collection for commercial and firewood removals. • SOC dynamics under certain lad use, management practices and Inputs. • Develop system for monitoring the natural disturbance and prompt evidence.
Waste Sector	
Data from actual waste disposed in landfills not available.	Maintain accurate records of the quantity of waste deposited at all of Solomon Islands landfills and controlled dumps either through weighbridges or accounting for number of truckloads received at each site.
Emissions for healthcare waste incineration are not estimated.	Establish regular, standardized, and mandatory record-keeping and reporting of healthcare waste generation and treatment practices, including incineration.

Emissions from domestic wastewater treatment and discharge are estimated.	• Regularly collect data on the quantity and characteristics of domestic wastewater generated and treated on-site, including treatment systems implemented. • Establish a system for frequent and standardized BOD measurements specific to each wastewater treatment and discharge stream, including sewerage, septic systems, and latrines. • Lack of data on type of wastewater treatment system and discharge pathway • Estimate or collect data on per capita dietary protien consumption rate per capita of the country during the next inventory
Uncertainty assessment/ all sectors	Activity data uncertainty is not collected in any sector and therefore not estimated. IPCC default values are utilised instead. Provide sector specific trainings on how to collect data and information to establish uncertainty.
Baseline year adjustment and time series consistency	• Re-evaluate the GHGI baseline year to ensure it reflects data availability across all relevant sectors. • Vanuatu utilizes 1994 as the baseline year, however 2007 may be considered as the base year as this year marks the beginning of consistent and complete data availability across multiple sectors.

Annexures

Annex I: Key categories

A key category has a significant influence on a country's total inventory of direct greenhouse gases in terms of absolute level of emissions, the trend in emissions, or both. Vanuatu has identified the key sources for the inventory using the tier 1 level and trend assessments as recommended in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC 2006). This approach identifies sources that contribute to 95 per cent of the total emissions or 95 per cent of the trend of the inventory in absolute terms.

Approach 1 Level Assessment

Key Categories without LULUCF sector:

When the LULUCF sector is included in the analysis, Vanuatu has identified the following sectors as the key categories in the order of their contribution to the total national GHG emissions:

- 3.A Enteric Fermentation
- 1.A.3.b Road Transportation
- 3.B Manure Management
- 1.A.1 Energy Industries
- 5.A Solid Waste Disposal
- 1.A.2 Manufacturing industries and construction
- 1.A.3.d Water-borne Navigation

The full results for the key source analysis excluding LULUCF is presented in table below.

A	B	C	D	E	F	G
IPCC Category code	IPCC Category	Greenhouse gas	2023 Ex,t (Gg CO2e)	|Ex,t| (Gg CO2e)	Lx,t	Cumulative Total of Column F
3.A	Enteric Fermentation	METHANE (CH4)	216.90	216.90	0.4272	0.427
1.A.3.b	Road Transportation	CARBON DIOXIDE (CO2)	77.01	77.01	0.1517	0.579
3.B	Manure Management	METHANE (CH4)	65.27	65.27	0.1286	0.707
3.B	Manure Management	NITROUS OXIDE (N2O)	46.23	46.23	0.0911	0.799

1.A.1	Energy Industries	CARBON DIOXIDE (CO2)	43.35	43.35	0.0854	0.884
5.A	Solid Waste Disposal	METHANE (CH4)	16.47	16.47	0.0324	0.916
1.A.2	Manufacturing industries and construction	CARBON DIOXIDE (CO2)	12.83	12.83	0.0253	0.942
1.A.3.d	Water-borne Navigation	CARBON DIOXIDE (CO2)	8.59	8.59	0.0169	0.959
1.A.4	Other Sectors	CARBON DIOXIDE (CO2)	6.64	6.64	0.0131	0.972
5.D	Wastewater Treatment and Discharge	METHANE (CH4)	4.40	4.40	0.0087	0.980
1.A.3.a	Civil Aviation	CARBON DIOXIDE (CO2)	4.36	4.36	0.0086	0.989
5.D	Wastewater Treatment and Discharge	NITROUS OXIDE (N2O)	3.90	3.90	0.0077	0.997
1.A.3.b	Road Transportation	NITROUS OXIDE (N2O)	1.25	1.25	0.0025	0.999
1.A.3.d	Water-borne Navigation	NITROUS OXIDE (N2O)	0.12	0.12	0.0002	0.999
1.A.3.b	Road Transportation	METHANE (CH4)	0.11	0.11	0.0002	1.000
1.A.1	Energy Industries	NITROUS OXIDE (N2O)	0.09	0.09	0.0002	1.000
1.A.1	Energy Industries	METHANE (CH4)	0.05	0.05	0.0001	1.000
1.A.3.a	Civil Aviation	NITROUS OXIDE (N2O)	0.03	0.03	0.0001	1.000
1.A.2	Manufacturing industries and construction	NITROUS OXIDE (N2O)	0.03	0.03	0.0001	1.000
1.A.2	Manufacturing industries and construction	METHANE (CH4)	0.01	0.01	0.0000	1.000
1.A.3.d	Water-borne Navigation	METHANE (CH4)	0.01	0.01	0.0000	1.000
1.A.4	Other Sectors	METHANE (CH4)	0.00	0.00	0.0000	1.000
1.A.4	Other Sectors	NITROUS OXIDE (N2O)	0.00	0.00	0.0000	1.000
1.A.3.a	Civil Aviation	METHANE (CH4)	0.00	0.00	0.0000	1.000
Total						
			507.68	**507.68**	**1.00**	

Key categories with LULUCF sector:

When the LULUCF sector is included in the analysis the most significant key categories is 4A1 Forest land remaining forest land. The results of this latter analysis are presented in table below:

A	B	C	D	E	F	G
IPCC Category code	IPCC Category	Greenhouse gas	2023 Ex,t (Gg CO2e)	|Ex,t| (Gg CO2e)	Lx,t	Cumulative Total of Column F
4.A.1	Forest land remaining forest land	CARBON DIOXIDE (CO2)	-14088.79	14088.79	0.9652	0.965

3.A	Enteric Fermentation	METHANE (CH4)	216.90	216.90	0.0149	0.980
1.A.3.b	Road Transportation	CARBON DIOXIDE (CO2)	77.01	77.01	0.0053	0.985
3.B	Manure Management	METHANE (CH4)	65.27	65.27	0.0045	0.990
3.B	Manure Management	NITROUS OXIDE (N2O)	46.23	46.23	0.0032	0.993
1.A.1	Energy Industries	CARBON DIOXIDE (CO2)	43.35	43.35	0.0030	0.003
5.A	Solid Waste Disposal	METHANE (CH4)	16.47	16.47	0.0011	0.004
1.A.2	Manufacturing industries and construction	CARBON DIOXIDE (CO2)	12.83	12.83	0.0009	0.005
1.A.3.d	Water-borne Navigation	CARBON DIOXIDE (CO2)	8.59	8.59	0.0006	0.006
1.A.4	Other Sectors	CARBON DIOXIDE (CO2)	6.64	6.64	0.0005	0.006
5.D	Wastewater Treatment and Discharge	METHANE (CH4)	4.40	4.40	0.0003	0.006
1.A.3.a	Civil Aviation	CARBON DIOXIDE (CO2)	4.36	4.36	0.0003	0.007
5.D	Wastewater Treatment and Discharge	NITROUS OXIDE (N2O)	3.90	3.90	0.0003	0.007
1.A.3.b	Road Transportation	NITROUS OXIDE (N2O)	1.25	1.25	0.0001	0.007
1.A.3.d	Water-borne Navigation	NITROUS OXIDE (N2O)	0.12	0.12	0.0000	0.007
1.A.3.b	Road Transportation	METHANE (CH4)	0.11	0.11	0.0000	0.007
1.A.1	Energy Industries	NITROUS OXIDE (N2O)	0.09	0.09	0.0000	0.007
1.A.1	Energy Industries	METHANE (CH4)	0.05	0.05	0.0000	0.007
1.A.3.a	Civil Aviation	NITROUS OXIDE (N2O)	0.03	0.03	0.0000	0.007
1.A.2	Manufacturing industries and construction	NITROUS OXIDE (N2O)	0.03	0.03	0.0000	0.007
1.A.2	Manufacturing industries and construction	METHANE (CH4)	0.01	0.01	0.0000	0.007
1.A.3.d	Water-borne Navigation	METHANE (CH4)	0.01	0.01	0.0000	0.007
1.A.4	Other Sectors	METHANE (CH4)	0.00	0.00	0.0000	0.007
1.A.4	Other Sectors	NITROUS OXIDE (N2O)	0.00	0.00	0.0000	0.007
1.A.3.a	Civil Aviation	METHANE (CH4)	0.00	0.00	0.0000	0.007
Total						
			-13581.12	**14596.47**	**1.00**	

Approach 1 Trend Assessment

Key categories without LULUCF sector:

When the LULUCF sector is excluded in the analysis the most significant key categories identified are as follows. The results of this latter analysis are presented in table below:

- 1.A.3.b Road Transportation
- 1.A.3.d Water-borne Navigation
- 1.A.4 Other Sectors
- 1.A.1 Energy Industries

A	B	C	D		E	F	G	|F-G|	E x |F-G|		
IPCC Category code	IPCC Category	Greenhouse gas	1994 Year Estimate Ex0 (Gg CO2 Eq)	2022 Year Estimate Ext (Gg CO2 Eq)	|Ex0|/Σ|Ey0|	(Ext-Ex0)/|Ex0|	(ΣEyt-ΣEy0)/|ΣEy0|		Trend Assessment Txt	% Contribution to Trend	Cumulative Total
1.A.3.b	Road Transportation	CARBON DIOXIDE (CO2)	192.85	93.69	0.645	-0.514	1.090	1.605	1.036	53%	53%
1.A.3.d	Water-borne Navigation	CARBON DIOXIDE (CO2)	0.00	130.60	0.000	51770.888	1.090	51769.798	0.437	22%	75%
1.A.4	Other Sectors	CARBON DIOXIDE (CO2)	48.61	10.68	0.163	-0.780	1.090	1.871	0.304	16%	91%
1.A.1	Energy Industries	CARBON DIOXIDE (CO2)	53.68	65.64	0.180	0.223	1.090	0.868	0.156	8%	99%
1.A.3.b	Road Transportation	NITROUS OXIDE (N2O)	2.99	1.54	0.010	-0.485	1.090	1.576	0.016	1%	99%
1.A.3.d	Water-borne Navigation	NITROUS OXIDE (N2O)	0.00	1.86	0.000	332226.635	1.090	332225.545	0.006	0%	100%
1.A.3.b	Road Transportation	METHANE (CH4)	0.28	0.14	0.001	-0.504	1.090	1.595	0.001	0%	100%
1.A.4	Other Sectors	NITROUS OXIDE (N2O)	0.10	0.01	0.000	-0.922	1.090	2.012	0.001	0%	100%
1.A.3.d	Water-borne Navigation	METHANE (CH4)	0.00	0.19	0.000	65052.736	1.090	65051.645	0.001	0%	100%
1.A.4	Other Sectors	METHANE (CH4)	0.09	0.01	0.000	-0.931	1.090	2.021	0.001	0%	100%
1.A.1	Energy Industries	NITROUS OXIDE (N2O)	0.12	0.14	0.000	0.223	1.090	0.868	0.000	0%	100%
1.A.1	Energy Industries	METHANE (CH4)	0.06	0.07	0.000	0.223	1.090	0.868	0.000	0%	100%

1.A.3.a	Civil Aviation	CARBON DIOXIDE (CO2)	0.00	18.52	0.000	0.000	0.000	0.000	0.000	0%	100%
1.A.3.a	Civil Aviation	METHANE (CH4)	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0%	100%
1.A.3.a	Civil Aviation	NITROUS OXIDE (N2O)	0.00	0.14	0.000	0.000	0.000	0.000	0.000	0%	100%
2.D.1	Lubricant Use	CARBON DIOXIDE (CO2)	0.00	0.49	0.000	0.000	0.000	0.000	0.000	0%	100%
2.F.1.	Refrigeration and air conditioning	HFCs	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0%	100%
3.A	Enteric Fermentation	METHANE (CH4)	0.00	11.18	0.000	0.000	0.000	0.000	0.000	0%	100%
3.B	Manure Management	METHANE (CH4)	0.00	154.56	0.000	0.000	0.000	0.000	0.000	0%	100%
3.B	Manure Management	NITROUS OXIDE (N2O)	0.00	24.35	0.000	0.000	0.000	0.000	0.000	0%	100%
3.H	Urea application	CARBON DIOXIDE (CO2)	0.00	6.74	0.000	0.000	0.000	0.000	0.000	0%	100%
3.D	Agricultural soils	NITROUS OXIDE (N2O)	0.00	1.91	0.000	0.00	0.000	0.000	0.000	0%	100%
5.A	Solid Waste Disposal	METHANE (CH4)	0.00	79.99	0.000	0.000	0.000	0.000	0.000	0%	100%
5.D	Wastewater Treatment and Discharge	METHANE (CH4)	0.00	12.14	0.000	0.000	0.000	0.000	0.000	0%	100%
5.D	Wastewater Treatment and Discharge	NITROUS OXIDE (N2O)	0.00	9.95	0.000	0.000	0.000	0.000	0.000	0%	100%
Total			**Ey0**	**Eyt**					0.000	0%	
	Total GHG Emissions, excl. Removals		**298.77**	**624.55**					**1.959**		

Annex II: Uncertainty

IPCC category	Gas	Base year emissions (1994)	2023 emissions	AD uncertainty	EF uncertainty	Combined uncertainty	Contribution to variance by category in year 2023	Type A sensitivity	Type B sensitivity	Uncertainty in trend by EF	Uncertainty in trend by AD	Uncertainty introduced into the trend in total national emissions
		Gg of CO_2e		%	%	%		%	%	%	%	%
1A1 – Energy Industries	CO_2	12.67	43.35	10	7	12	0.002	44.056	0.689	308.392	6.888	95153.37
1A1 – Energy Industries	CH_4	0.03	0.05	10	100	100	0.000	0.10	0.00	9.71	0.01	94.31
1A1 – Energy Industries	N_2O	0.00	0.09	10	100	100	0.000	0.00	0.00	0.15	0.01	0.02
1A2 – Manufacturing Industries and Construction	CO_2	0.93	12.83	20	7	21	0.000	3.39	0.20	23.72	4.08	579.23
1A2 – Manufacturing Industries and Construction	CH_4	0.00	0.01	20	100	102	0.000	0.01	0.00	0.70	0.00	0.49
1A2 – Manufacturing Industries and Construction	N_2O	0.00	0.03	20	100	102	0.000	0.00	0.00	0.04	0.01	0.00
1A3 – Transport	CO_2	36.78	89.96	10	7	12	0.007	126.79	1.43	887.55	14.29	787957.46
1A3 – Transport	CH_4	0.03	0.13	10	100	100	0.000	0.11	0.00	10.70	0.02	114.45
1A3 – Transport	N_2O	7.26	1.40	10	100	100	0.000	24.88	0.02	2488.40	0.22	6192121.07
1A4 – Other Sectors	CO_2	4.77	6.64	25	7	26	0.000	16.46	0.11	115.21	2.64	13280.62
1A4 – Other Sectors	CH_4	0.01	0.00	25	100	103	0.000	0.04	0.00	3.68	0.00	13.53
1A4 – Other Sectors	N_2O	0.45	0.00	25	100	103	0.000	1.55	0.00	154.82	0.00	23967.81
3A – Enteric fermentation	CH_4	0.00	216.90	20	40	45	0.510	3.45	3.45	137.86	68.93	23755.41
3B – Manure management	CH_4	0.00	65.27	20	30	36	0.030	1.04	1.04	31.11	20.74	1398.30
3B – Manure management	N_2O	0.00	46.23	54	116	128	0.190	0.73	0.73	85.20	39.66	8832.99
4A1 – Forest Land Remaining Forest Land	CO_2	0.00	-14088.79	21	70	73	5747.770	-223.86	223.86	-15670.33	4701.10	267659576.77

5A- Managed Waste Disposal Sites	CH4	0.00	16.47	52	52	73	0.008	0.26	0.26	13.53	13.60	368.07
5D – Domestic Wastewater Treatment and Discharge	CH4	0.00	4.40	59	58	83	0.001	0.07	0.07	4.08	4.11	33.50
5D – Domestic Wastewater Treatment and Discharge	N2O	0.00	3.90	58	497	500	0.021	0.06	0.06	30.80	3.61	961.57

62.94	-13581.12	75.82	16577.34
Total 1994 emissions	**Total 2023 emissions**	**2023 inventory uncertainty (%)**	**1994-2022 trend uncertainty (%)**

Annex III: Detailed description of the reference approach (including inputs to the reference approach such as the national energy balance) and the results of the comparison of national estimates of emissions with those obtained using the reference approach

The reference approach estimates CO_2 emissions from fuel combustion activities is calculated using the 2006 IPCC guidelines. Under the reference approach, GHG emissions were estimated using only the fuel consumption data for each type of fuel. The data received from the Vanuatu National Statistics Office (VNSO), Customs department and Fuel suppliers is compared against the sectoral fuel data provided by the Department of Energy.

The difference in estimates of CO_2 emissions from fuel combustion using the sectoral and reference approaches was within ±1%.

Inventory Year	Reference Approach				Sectoral Approach		Difference	
	Apparent Consumption (TJ)	Excluded Consumption (TJ)	Apparent Consumption - Excluding Non-energy uses (TJ)	CO_2 Emission (Gg)	Energy Consumption (TJ)	CO_2 emission (Gg)	Energy Consumption (%)	CO_2 emission %
2007	823.077	8.828	814.248	59.576	820.309	59.959	-0.7%	-0.6%
2008	1272.523	28.061	1244.462	90.992	1254.144	91.603	-0.8%	-0.7%
2009	1305.337	26.770	1278.567	93.147	1297.223	94.324	-1.5%	-1.3%
2010	1780.061	147.613	1632.448	118.590	1632.448	118.590	0.0%	0.0%
2011	1965.532	146.494	1819.038	129.852	1838.778	126.320	-1.1%	2.7%
2012	1934.882	224.471	1710.411	124.146	1569.688	113.719	8.2%	8.4%
2013	1989.620	331.487	1658.134	120.290	1658.134	120.290	0.0%	0.0%
2014	2093.339	341.530	1751.809	127.251	1775.004	127.251	-1.3%	0.0%
2015	2132.400	367.824	1764.576	128.206	1764.576	128.206	0.0%	0.0%
2016	2311.042	296.642	2014.399	146.638	2044.317	148.816	-1.5%	-1.5%
2017	2530.766	338.196	2192.570	159.669	2530.766	179.109	-15.4%	-12.2%
2018	2574.639	388.410	2186.229	159.049	2209.761	160.758	-1.1%	-1.1%
2019	2610.602	371.196	2239.406	162.919	2257.300	164.220	-0.8%	-0.8%
2020	2333.353	159.855	2173.498	158.022	2190.295	159.244	-0.8%	-0.8%
2021	2223.311	115.895	2107.416	153.071	2107.423	153.071	0.0%	0.0%
2022	2278.033	233.687	2044.346	148.388	2037.599	147.915	0.3%	0.3%
2023	2189.211	84.484	2104.727	152.787	2104.735	152.788	0.0%	0.0%

Annex IV: Common reporting tables

(To be included)

III. Information necessary to track progress made in implementing and achieving nationally determined contributions under Article 4 of the Paris Agreement

National circumstances and institutional arrangements

The Chapter 1 (National Circumstances and Institutional Arrangements) of the Biennial Transparency Report (BTR) provides a comprehensive overview of Vanuatu's government structure, population profile, geographical profile, economic profile, climate profile, and sector details Furthermore, details on how the national circumstances affect greenhouse gas (GHG) emissions and removals over time are presented in Chapter 2 (National inventory report of anthropogenic emissions by sources and removals by sinks of greenhouse gases) of the BTR.

Vanuatu has the institutional structure for implementation of the enhanced NDC. The National Advisory Board on Climate Change & Disaster Risk Reduction (NAB) is the supreme policy making and advisory body for all disaster risk reduction and climate change programmes, projects, initiatives and activities in Vanuatu.

The NAB develops Disaster Risk Reduction (DRR) and Climate Change policies, guidelines and positions, advises on international and regional DRR and CC obligations, facilitates and endorses the development of new DRR and CC programmes, projects, initiatives and activities, acts as a focal point for information sharing and coordination on CC/DRR, and guides and coordinates the development of national climate finance processes.

The Ministry of Climate Change Adaptation (MoCC) is the nodal agency as part of the Government's efforts to streamline Vanuatu's climate change natural disaster responses and sustainable development of the environment. It was created in 2014 to strategically align the departments responsible for natural disaster response and sustainable environmental development. Its vision is to "promote a resilient, sustainable, safe and informed Vanuatu" and its mission is to "develop sound policies and legislative framework and provide timely, reliable, scientific information for service delivery to enable resilient communities, a sustainable environment and economic development.

The MoCC includes the Vanuatu Meteorological and Geo-hazards Department, the National Disaster Management Office, DoE, the Department of Environment (DoENV) and the Project Management Unit. The ministry and the NAB are charged with coordinating all government and non-government initiatives addressing climate change and DRR in the country.

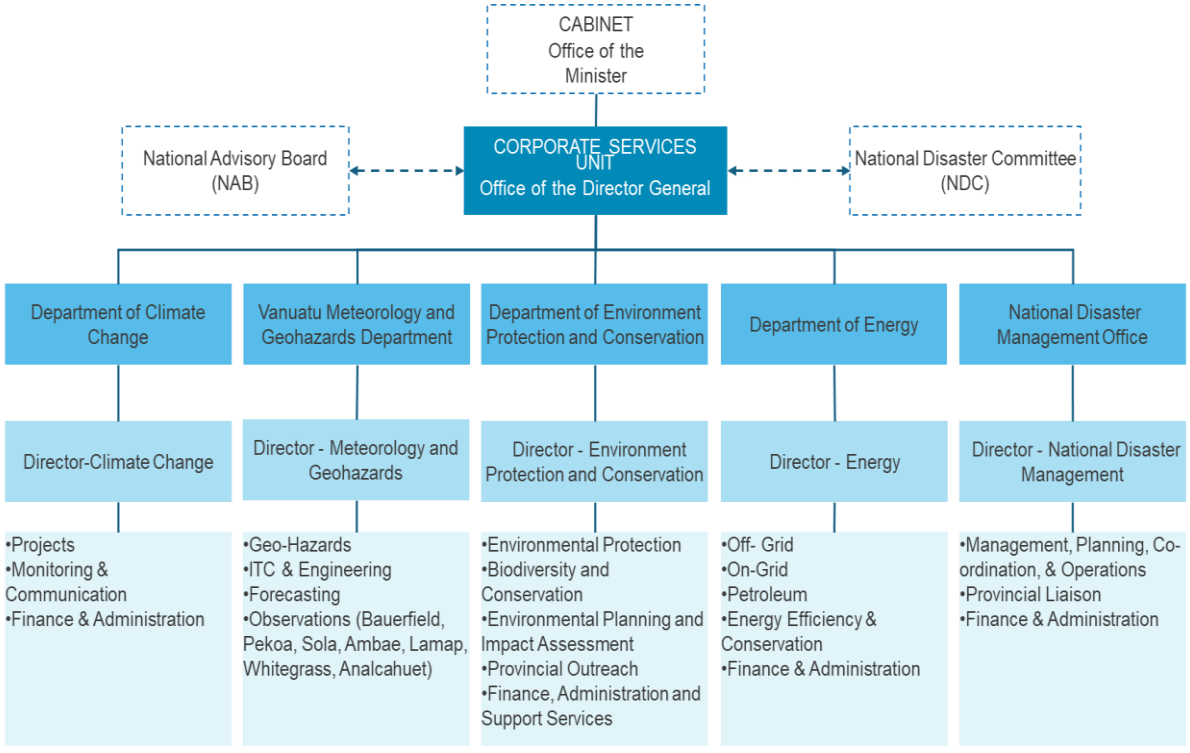
The DoCC was established as part of the GoV's ongoing efforts to enhance national resilience in the face of global climate change impacts. The department has been formed and mandated as per the Meteorology, Geological Hazards and Climate Change Act No. 25 of 2016 (Climate Change Act).[13] The Department of Climate Change (DoCC), within the Ministry of Climate Change, is mandated to ensure that high quality services are provided in relation to climate change in Vanuatu. The Ministry and the National Advisory Board (NAB) are mandated with coordinating all government and non-government initiatives addressing climate change and disaster risk reduction in the country.

The DoE is responsible for central coordination of development of the energy sector (climate change mitigation). This includes existing electricity grids, the petroleum sector and energy efficiency issues. The DoE is also responsible for the development of electricity access in rural areas.

The following are the key institutions involved and stakeholders in NDC implementation:

- National Advisory Board (NAB) on Climate Change and Disaster Risk Reduction
- Department of Climate Change (DoCC)
- Department of Energy (DoE)
- Utilities Regulatory Authority (URA)
- Other line ministries and departments
- Power utilities – private sector
    - UNELCO Engie (UNELCO) and Vanuatu Utilities & Infrastructure Limited (VUI)
- Non-governmental organizations (NGOs) and other private sector service providers

Figure 1: Vanuatu's Climate Change-Organizational Structure



[13] https://www.vmgd.gov.vu/vmgd/images/admin-media/docs/Official-Gazette-No.-6-of-2017-dated-1-February-2017.pdf

NDC MONITORING, REPORTING AND VERIFICATION (MRV)

National MRV Framework of Vanuatu

Vanuatu under its updated NDC programme has developed an integrated MRV tool including training and capacity building to cover mitigation sectors under the updated NDC to increase ambition and action by carrying out a detailed assessment of potential high impact sectors that can contribute to low-carbon development.

The Vanuatu's Integrated MRV Tool aims to assist the Department of Climate Change (DoCC), MOCC, Department of Finance and other line ministries/departments to develop a concise and strategic domestic national MRV system to enhance monitoring, tracking, reporting and verifying of climate actions including GHG emissions; mitigation, adaptation and SDG impact of projects, programme, policies etc.; and international, regional and domestic public and private climate finance flows. The Vanuatu's integrated MRV Tool is a robust tool built on available resources e.g. data, human resources, capacity etc. and existing systems of monitoring and reporting (data collection and analysis); with minimal additional burden to the reporting agency and relevant stakeholders.

Figure 2: Vanuatu's Integrated MRV Tool

Vanuatu's Integrated MRV Tool is an Information and communications technology (ICT) based digital MRV system specifically considering the specific requirements of Vanuatu and finalized post extensive desktop review of documents, stakeholder consultation and discussion with MoCCA. However, since MRV requires continuous development and gradually increasing the efficiency and capacity, the iMRV tool also apply the learning by doing and require periodic incorporation of best practices and lesson learned.

MRV Tool – Design Principle

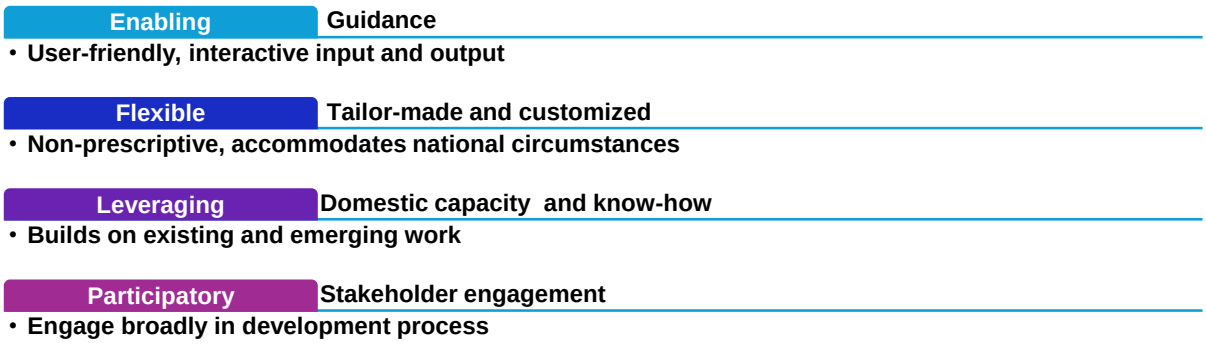


Figure 3: MRV Tool: Design Principles

The integrated MRV tool has been developed using simple design principles to provide an 'enabling' system for the MRV user and stakeholders. The iMRV tool has a user-friendly interface and the modular approach adopted accommodates specific national circumstances and future development. 'The iMRV tool builds on existing and emerging work in the country and uses domestic expertise, including engaging strategic process stakeholders broadly in development processes.

The iMRV Tool has been developed and finalized after the extensive stakeholder consultation process, however this is a living tool and can be further improved over the period of time. Hence some of the features/requirements are kept for future development and implementation.

Integrated MRV Tool – Key Features

The iMRV Tool transparently demonstrate progress made towards the targets defined in the national policies and frameworks such as Climate Change Action Plan (CCAP), Nationally Determined Contributions (NDC) etc. Besides measuring ex-post emissions, baseline and mitigation actions, the national MRV system also aimed to track the progress of implementation in terms of other impacts (e.g., policies, co-benefits, achieving SDGs), plus results of means of implementation (e.g., tracking of climate finance flows, technology transfer, capacity building). The present version of integrated MRV Tool covers following key elements for NDC tracking:

- National GHG Inventory (limited to key sector and sub-sectors)
- Monitoring and Tracking: Climate Change Mitigation Actions/Projects and GHG emission reductions
- Monitoring and Tracking: Climate Change Adaption Actions/Projects and Impacts;
- Monitoring and Tracking: Climate Finance Flow towards Climate Actions;
- Monitoring and Tracking: SDG impact of climate actions.

Monitoring GHG emission reductions, SDG parameters and financial flows for each project/programme will also improve international/bilateral cooperation. The resulting GHG emission reductions may also be used as internationally transferred mitigation outcomes under Article 6 of the PA. The integrated MRV tool also meets most of the ETF requirements under the Agreement and can be expanded for market and non-market approaches under its article 6.

Figure 4: Integrated MRV Tool: Key features

The unique feature of the integrated MRV tool is its ability to monitor, track and report the Sustainable Development Indicators and Goals (SDGs) (environmental, social and economic impacts as per the UNDP Climate Action Impact Tool (CAIT) for each climate action (mitigation action and adaptation activities) at the project/programme level. This is extremely helpful in aligning climate actions, including NDCs, National Adaptation Plans (NAP) and Nationally Appropriate Mitigation Actions (NAMAs) with the SDGs by linking climate actions policies and priorities to national SDGs.

Finally, the integrated MRV tool helps to achieve multiple objectives, such as: tracking and reporting GHG inventory and progress on climate actions and NDCs; promoting integrated national planning; and assessing transformational impacts resulting from processes and outcomes of policies and actions intended to drive structural social changes towards climate change mitigation, adaptation and sustainable development.

Integrated MRV Tool – Key Components

The integrated MRV tool is a one-of-its-kind initiative to integrate most of the domestic and international climate action monitoring/data collection, tracking, reporting and verification of: GHG emissions (inventory) in accordance with 2006 Intergovernmental Panel on Climate Change (IPCC) guidelines; the impact of mitigation actions (NDC); the impact of adaptation activity; climate finance flows (support received/needed); and (5) SDG impacts, based on the UNDP CAIT.

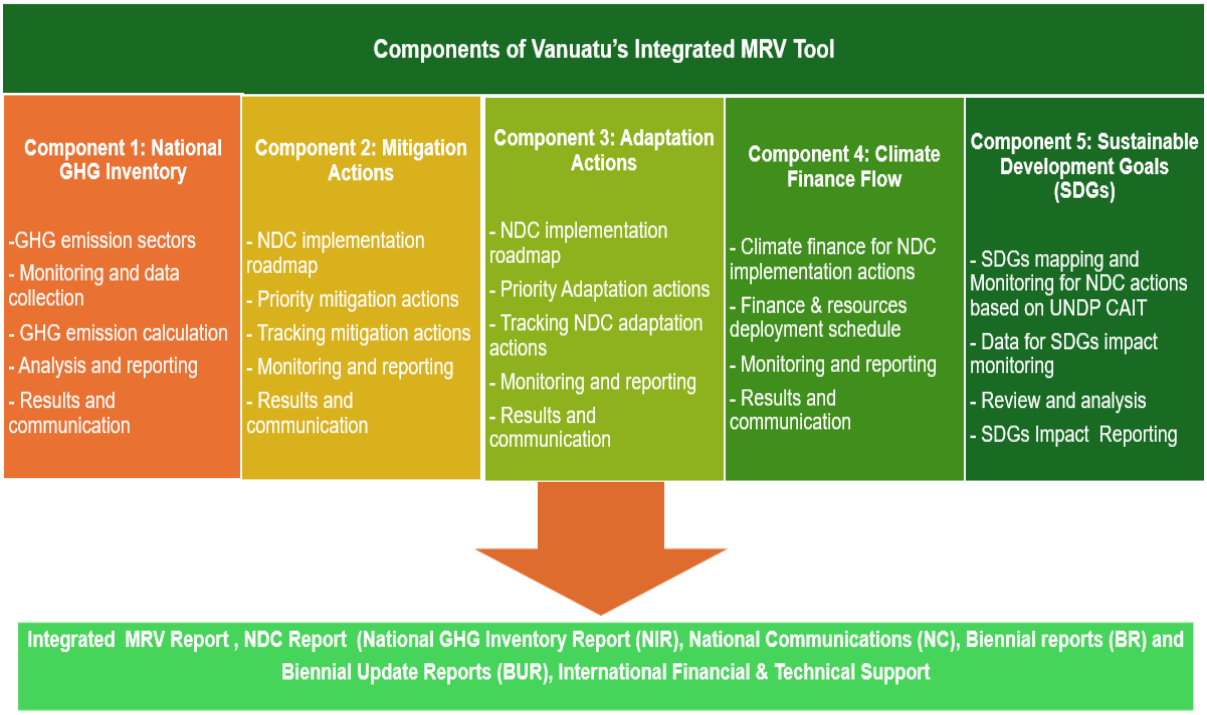
The iMRV tool developed for Vanuatu is an information and communications technology, web-based (AWS cloud server) MRV system designed specifically to address national requirements in Vanuatu. It is based on an extensive desktop review of documents, followed by stakeholder consultations and discussions with the MoCCA The tool provides an overarching structure, approach, and methodology for:

- National GHG emission monitoring and inventorying;
- International and domestic reporting requirements (e.g., modalities, procedures and guidelines for the transparency framework for action and support referred to in Article 13 of the PA, NC, BUR and other);
- Real-time monitoring, progress reporting on and archiving of GHG mitigation and climate change mitigation actions;
- Real-time monitoring of, progress reporting on and archiving the impact of climate change adaptation actions;
- Climate financial flows and progress towards implementation of climate actions; and,

- Monitoring of, progress reporting on and archiving the impact of climate change actions (both mitigation and adaptation) on the SDGs.

Existing national processes for data gathering and monitoring were examined before the MRV system was designed and implemented to allow for efficient integration of the existing arrangement. Appropriate monitoring indicators and parameters (for example, sectoral and sub-sectoral data needs) were identified so that the key parameters could be monitored at the NDC action, sectoral or subsector level.

Figure 5: Vanuatu's integrated MRV tool: Key components



The integrated MRV Tool has been structured into two main parts:

GHG Inventory (Module: 1): The GHG Inventory Module uses the IPCC-2006 guidelines for GHG Inventory from applicable sectors and sub-sectors for Vanuatu. This module has been customized to cater to the specific requirements of Vanuatu and only covers sectors and sub-sectors applicable for Vanuatu's GHG Inventory. Further the simplified Tier-1 approach has been used to calculate the GHG emissions. Please refer annexure-1 for detailed process flow:

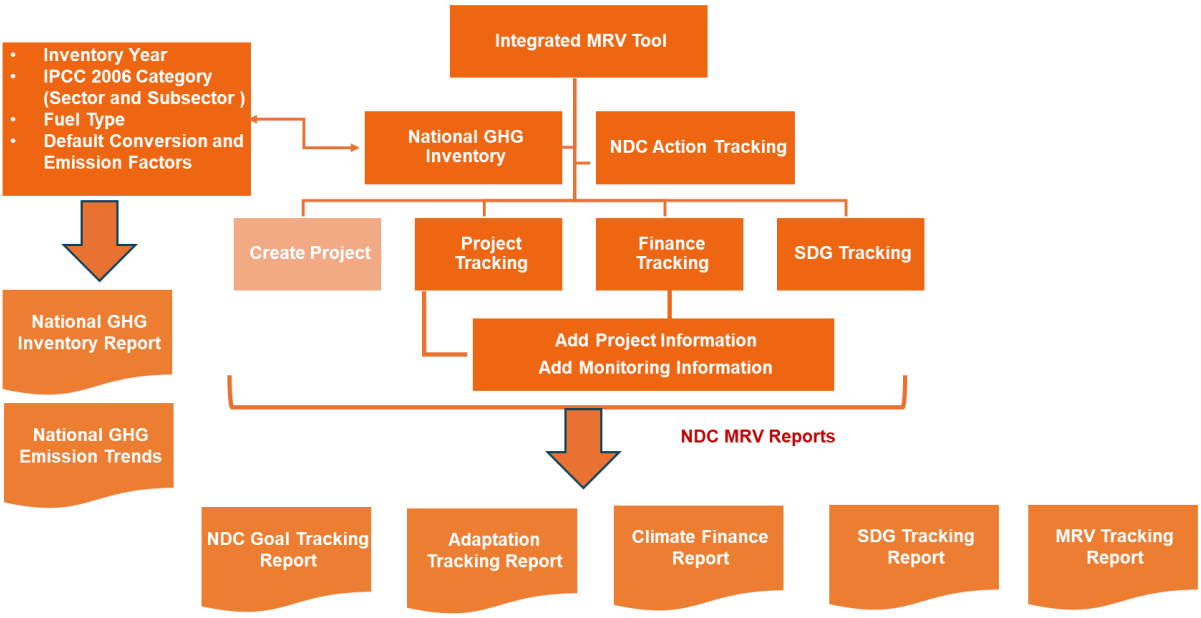
NDC Action Tracking Modules

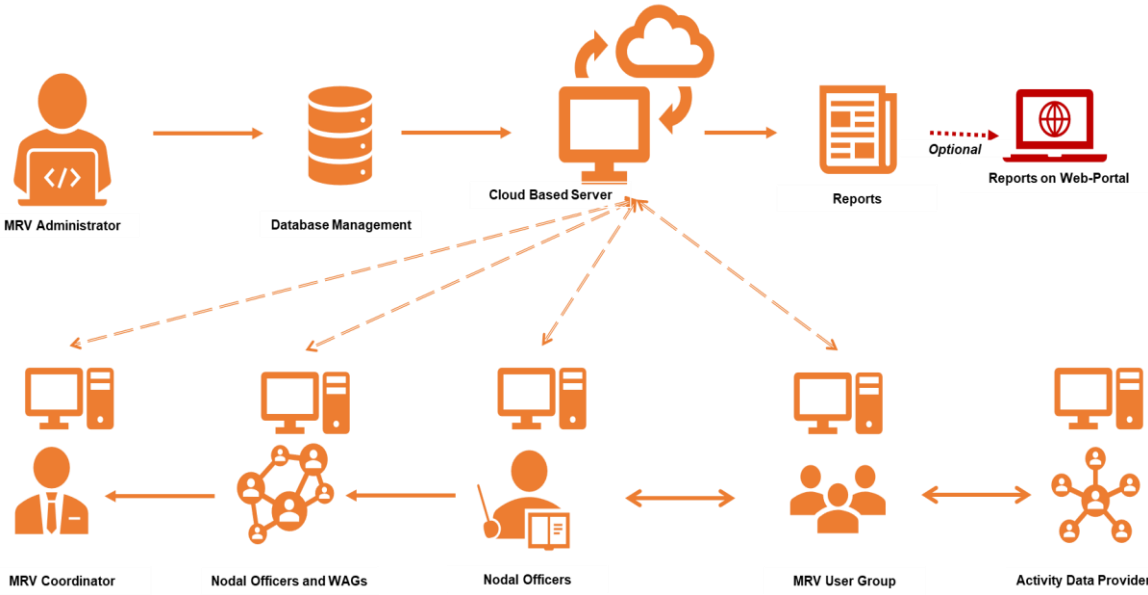
a. Mitigation Actions (Module:2)
b. Adaptation Actions (Module:3)
c. Climate Finance Module (Module: 4)
d. SDGs Assessment (Module: 5)

Integrated MRV Tool - Operational Structure

The operational structure of integrated MRV Tool is presented in the figure below:

Figure 6: Structure of Vanuatu's Integrated MRV Tool

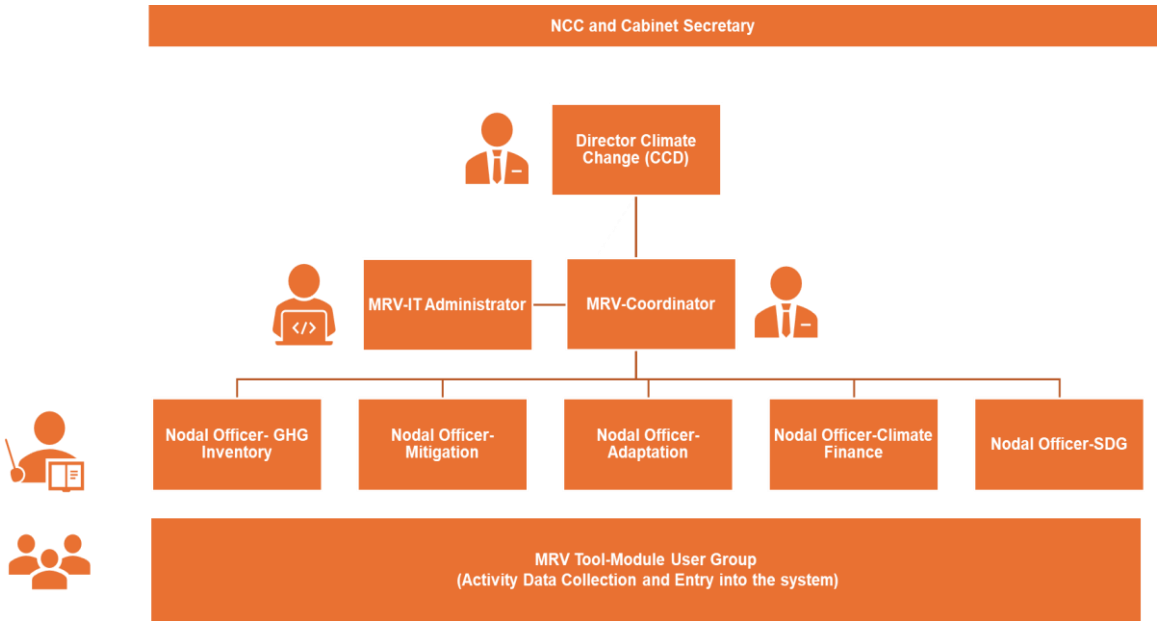




Integrated MRV Tool – Institutional Structure

The users of integrated MRV Tool are the members of the MoCCA team (or any other relevant team (s) assigned by MoCCA for preparation of national GHG inventories, NDC Actions/Mitigation/Adaptation Monitoring, Climate Finance/Support monitoring and SDG Tracking.

Figure 7: Overarching Institutional Structure for Integrated MRV Tool



Roles and responsibility of key officials are presented here:

Director Climate Change Department: The Director, Department of Climate Change (DoCC) shall be heading the entire MRV system. The Director – DoCC shall further update to the MoCCA, NAB on the implementation and progress of MRV System.

MRV Coordinator: The MRV coordinator shall have overall responsibility of integrated MRV Tool and MRV Reports. MRV Coordinator shall review the MRV System and MRV reports on periodic basis (quarterly, half yearly) or at least once in a year; shall also responsible for backstopping and capacity building.

MRV Administrator: Shall have overall responsibility of iMRV Tool implementation and functions. MRV Administrator will be a Master User with all privileges and rights; shall also Approve, edit and delete user registration and access, approve/edit emission factors, database etc. on recommendation of MRV Coordinator or Nodal Officer.

Nodal Officers: Shall have the right to Validate and Verity the entered activity data. Each Module shall have at least one Nodal Officer; designated by the MRV Coordinator. Nodal officer shall validate and verify the activity data entered in the iMRV tool i.e., approve or reject.

MRV Module and Sector User Group: Will have the right to enter/edit data in respective sector(s). Module or Sector Users will be provided these rights by the MRV Administrator on recommendation of their Nodal Officer or MRV Coordinator.

Each user is assigned a role and different levels of the access rights, roles are not necessarily identical to a person's title (e.g., National Focal Point) and that a person can take on several roles.

User Registration: At first, each user needs to register with the MRV administration system. The process of registration will be a simple web-based process, where in user need to fill-in

the registration form with personal details, roles and level of access required and submit for approval with the relevant authority.

The MRV-IT Administrator shall approve the user registration and on approval user can access the integrated MRV Tool using the internet connection on any device (work computer, home computer, laptop, tablet etc.).

Monitoring, Reporting, and Verification Tool for NERM 2016–2030

Vanuatu launched the Updated National Energy Road Map (NERM) Implementation Plan in 2019. A web-based MRV tool to monitor the status and progress of projects against NERM and National Sustainable Development Plan (NSDP) was established. Vanuatu's NERM 2016–2030 formed the basis for developing the initial NDC and, as such, is critical for achieving Vanuatu's stated NDC targets.

Vanuatu National Forest Monitoring System

Vanuatu has developed the National Forest Monitoring System for Vanuatu serving as the Measurement, Reporting and Verification (MRV) System for REDD+, The system is accessed online only via validated users through logins, with different users assigned different access rights. It is possible for the NFMS to be utilised as a broader land use information portal beyond REDD+, and thus is suitable for other land-based carbon projects to use the NFMS to nest their projects within the national program.

The NFMS includes the following components:

The Satellite Land Monitoring System (SLMS) is linked to a web-based Forest Information System (FIS). The SLMS provides a standard process to periodically assess activity data. The FIS provides analysis and aggregation tools needed to report forest and other land use change information for a defined period in a web-based database environment. The first period assessed was 2008 to 2017 representing the Reference Period for the development of the Forest Reference Level (FRL).

The National Forest Inventory (NFI) was designed, personnel trained, and implemented under the supervision of the Department of Forestry between 2019 and 2021. Among many other parameters, the NFI collects all information needed to quantify forest and other land use carbon stocks. The NFMS database then provides the analytical tools relevant for analyzing and reporting the aggregated Emission factors (EF). The Forest Carbon Registry presents carbon stock information while the emission factors are directly linked with the FIS.

The Safeguard Information System is a platform for distribution of benefits, recording impacts, and governance safeguards. The SIS platform in the NFMS will collect and manage information on how REDD+ safeguards (Cancun Safeguards) are being addressed and respected in the next phase of REDD+ implementation in Vanuatu.

The final main component is the NFMS Dashboard, the central monitoring and reporting platform of the System. The dashboard is a web application that combines and allows access to specific results from the individual components for national and sub-national stakeholders for reporting. This includes standard automated reports and GIS-based visualization.

Figure 8: Framework for the NFMS for REDD+ in Vanuatu

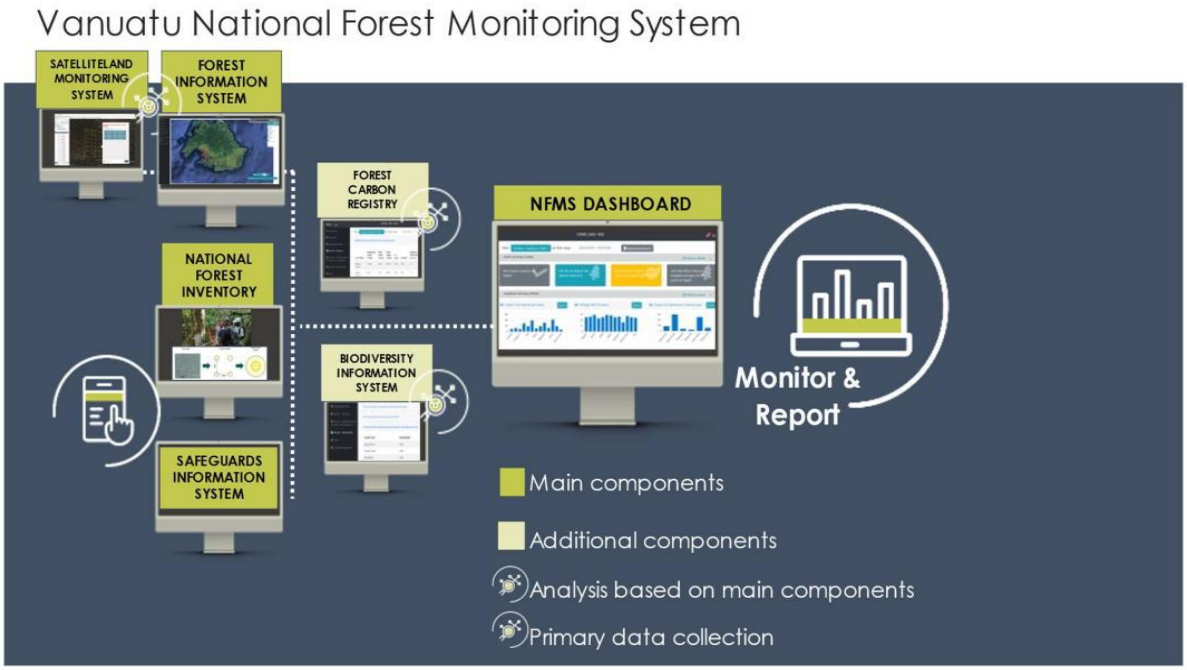
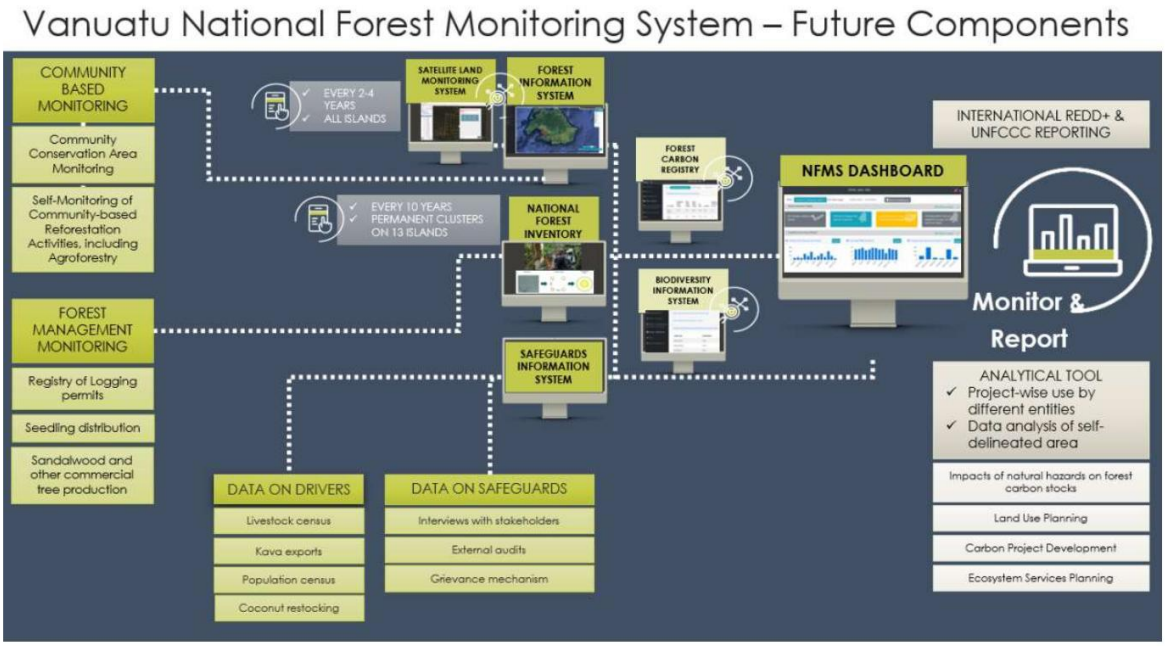


Figure 9: NFMS in Vanuatu with identified additional monitoring components



Description of a Party's nationally determined contribution under Article 4 of the Paris Agreement, including updates

Pursuant to Articles 4.2 and 4.11 of the PA and Decision 1/CP.21 paragraph 23, the Republic of Vanuatu, taking into account its national circumstances and capabilities, hereby submitted its revised and further enhanced Nationally Determined Contribution under the agreement for 2021–2030 in December 2021. The Government of the Republic of Vanuatu notes with great

concern that the objective of the agreement can only be achieved by intensifying the level of action significantly, complemented by international support, to achieve conditional contributions, as reflected in the Nationally Determined Contribution (NDC).

Vanuatu's Revised and Enhanced 1st Nationally Determined Contribution reflecting highest-level ambitions on adaptation, mitigation, and loss and damage is a national policy with a multi-sectoral approach. The timeframe of this policy is 10 years covering the period from 2021 to 2030. The overall purpose of this policy is GHG emissions reductions.

Table 1: Description of Vanuatu's NDC

Target(s) and description, including target type(s), as applicable	Target: Absolute emission reductions Target type: Activity-based mitigation targets, sectoral and policy targets in key sectors, including emissions reduction in some sub-sectors. The GHG emission reduction targets in this section are all conditional upon international support (financial and technical support) made available.
Target year(s) or period(s), and whether they are single-year or multi-year target(s), as applicable	Single-year target 2030, including updates in 2025. (The NDC interventions will be implemented in phases as per annual work plans; however, the target final year is 2030).
Reference point(s), level(s), baseline(s), base year(s) or starting point(s), and their respective value(s), as applicable	Base year: 2010 As per the Greenhouse Gas Inventory (under the second National Communication Report), the net GHG emissions (excluding removals) for the base year, was 728.359 Gg CO_2eq. The direct GHG emission for the following IPCC sectors is: • Energy: 122.44 Gg Gg CO_2eq • IPPU: 0 Gg Gg CO_2eq • AFOLU: 587.48 Gg CO_2eq • Waste: 10.75 Gg CO_2eq • Others: 0 Gg CO_2eq.
Time frame(s) and/or periods for implementation, as applicable	From 1 January 2021 – 31 December 2030.
Scope and coverage, including, as relevant, sectors, categories, activities, sources and sinks, pools and gases, as applicable	The IPCC Sectors, Sub-sector and Gases applicable for Vanuatu: 1. Energy • Energy Industries - Electricity • Generation/Renewable Energy • Transport • Other Sectors (Residential, Institutional and Commercial) 2. Industrial Processes and Product Use (IPPU) - Not Applicable 3. Agriculture, Forestry, and Other Land Use (AFOLU) • Livestock • Forests – Not Included 4. Waste • Solid Waste • Wastewater Gases: • Carbon Dioxide (CO2) • Methane (CH4) • Nitrous Oxide (NO2) A co-benefit of reducing CO2 emission from the above-mentioned sectors is that there will also be

	concomitant reductions in emissions in other gases like NMVOCs. The Adaptation and Loss and Damage sectors covered by this NDC include: • Agriculture • Biosecurity • Fisheries • Forestry • Livestock • Water • Health • Environment • Oceans • Waste • ICT • Infrastructure • Disability • Gender • Human Rights • Indigenous • Youth • Collaboration • Decentralisation • Governance • Policy • Meteorology • Tourism • Finance
Intention to use cooperative approaches that involve the use of ITMOs under Article 6 towards NDCs under Article 4 of the Paris Agreement, as applicable	
Any updates or clarifications of previously reported information, as applicable	Not applicable

Information necessary to track progress made in implementing and achieving its nationally determined contribution under Article 4 of the Paris Agreement

In line with the modalities, procedures, and guidelines (MPGs) of the ETF of the Paris Agreement, Vanuatu has identified absolute GHG emission reductions (Gg CO_2e) as indicators to track progress towards the implementation and achievement of its NDC under Article 4. Table 2 detail the indicators selected to monitor progress in implementing and achieving these mitigation targets of Vanuatu's NDC.

Table 2: Indicators selected to monitor progress in implementing and achieving these mitigation targets of Vanuatu's NDC

Time Period: 2021-2030			
Scope	**Vanuatu's enhanced NDC Roadmap's scope is sector-specific and focuses only on mitigation actions (all conditional mitigation targets)**		
Baseline scenario	**Business-as-usual (BAU) scenario and ex-ante GHG emissions baseline**		
Enhanced NDC Mitigation Actions (Sector/Sub-sectors)		**Indicator**	**GHG Mitigation (Gg CO_2e/Year)**
Energy Sector NDC Actions			
Energy Industry (Electricity Generation Sub-sector)			
NDC Action 1:	**Renewable Energy Capacity Addition**	100% below BAU emissions for electricity sub-sector and 30% for energy sector as a whole.	**61.57**
NDC Action 2:	**Substituting and/or Replacement of Fossil Fuels with Coconut (Copra) Oil based Electricity Generation**		
Transport Sub-Sector			
NDC Action 3:	**Improve transport (land and marine) Energy Efficiency**	**10**% improvement in transport energy efficiency by 2030	**9.86**
NDC Action 4:	**Electric Vehicles (e-Mobility)**	10% of total public buses replaced with electric buses	**2.61**
NDC Measure 4.1	**Electric Vehicles (e-buses) for public transportation (10% of total Public Buses)**	10% of Government fleet	**1.84**
NDC Measure 4.2	**Electric Cars (e-Cars) in Vanuatu (10% of government fleet)**	replaced with electric cars	**0.08**
NDC Measure 4.3	**1000 Electric Two (e-bikes) /Three Wheelers (e-rickshaw)**	1000 numbers of electric two/ three wheelers	**0.68**
NDC Action 5	**20 % Bio-diesel (bio-fuel) Blending in Diesel**	20% of bio-diesel blending achieved	**18.5**
NDC Action 6	**Mileage and Emission Standards for Vehicles**	Milage and emission standards endorsed by Council of Ministers	**0.29**
Other Sectors (Residential, Commercial, Institutional and other uncategorised sub-sectors)			
NDC Action 7	**Biogas Plants for Commercial and Residential Use (1000 numbers)**	1000 number of biogas plants made operational	**3.5**
NDC Action 8	**Energy Efficiency in Commercial and Residential Sector**		**0.35**
NDC Measure 8.1	**5% of Energy Efficiency in Commercial and Residential Sector**	5% energy efficiency achieved	**0.35**
NDC Measure 8.2	**10 No of Energy Efficient Building (Green Buildings)**	10 energy efficient buildings constructed	**NE**
NDC Action 9 (Circular Economy Strategy)	**Ecotourism Supported by Local Communities**	**NE**	**NE**
Industrial Processes and Product Use (IPPU) Sector - Not Applicable			
Agriculture, Forestry, and Other Land Use (AFOLU) Sector			
Agriculture - Not Applicable			
Livestock			
NDC Action 10	**Training and capacity building for livestock farming and pasture management**	Number of training and capacity building programmes conducted	**NE**
NDC Action 11 (Circular Economy Strategy)	**Converting Pastures to Silvopastural Livestock Systems**	Hectares of land switched to silvopastoral system	**30.98**
NDC Action 12 (CE)	**International Collaboration to Improve Livestock Efficiency**	Number of collaborative initiatives facilitated	**NE**
Forests - Not Included			
Waste Sector			
Solid Waste (Municipal Solid Waste)			
NDC Action 13	**Waste to Energy Plant for Municipal Solid Waste (MSW)**		**14.85**

NDC Measure 13.1	**Waste to Energy Plant for Port Villa**	Municipal Waste to energy plant made operational in Port Vila	**14.27**
NDC Measure 13.2	**Waste to Energy Plant for Luganville**	Municipal Waste to energy plant made operational in Luganville	**0.5**
NDC Measure 13.3	**Waste to Energy Plant for Lenakel**	Municipal Waste to energy plant made operational in Lenakel	**0.08**
NDC Action 14 (CE)	**Compost municipal organic waste to produce soil enhancer**	Tonnes of compost produced	**10.94**
NDC Action 15 (CE)	**Collect, Sort and Export Recyclable Materials (indicative) for first phase for Port Vila**	NE	**NE**
NDC Action 16 (CE)	**National Plastics Strategy**	Strategy developed and endorsed by Council of Ministers	**NE**
Waste Water (Domestic Waste Water)			
NDC Action 17	**Waste Water Management System in Vanuatu**		**3.57**
NDC Measure 17.1	**Centralised Waste water collection and treatment system in municipal area including awareness and capacity building**	Waste water reticulation & treatment systems installed	**1.07**
NDC Measure 17.2	**Improvements to Public and Communal Toilet Facilities including Bio- Toilets**	NE	**2.5**
Total GHG Mitigation Potential (excl. Removals)			**157.01**
Note: NE=Note Estimated, NERM= National Energy Roadmap:2016-2030, CE = Circular Economy Strategy			

The following summary tables present information that tracks progress on Vanuatu's NDC contributions. This is presented by NDC mitigation action:

NDC Action/Measure:1 and 2- Renewable Energy Capacity Addition and: Substituting and/or Replacement of Fossil Fuels with Coconut (Copra) Oil based Electricity Generation	
Description	This NDC Action is focused on transitioning to close to 100% renewable energy in the electricity generation sub-sector under energy sector.
Objectives	1. Increase the use of renewable energy as a way to reduce GHG emissions; provide affordable, reliable energy access; and facilitate green growth. 2. Increase the use of Coconut (Copra) Oil as a substitute for diesel fuel for electricity generation.
Output	100% below BAU emissions for electricity sub-sector and 30% for energy sector as a whole.
Outcome	Achievement of targets under NERM 2016:2030 and NAMA interventions.
GHG Emissions Reductions	61.57 Gg CO_{2e}/Year
NSDPs Impact	SOC 6.6, ENV 2.2, ENV 2.3, ECO 2.1, ECO 3.3, ECO 4.3, ECO 4.5
SDGs Impacts	SDG 7, SDG 8, SDG 13
Cost (USD)	Budgeted under NERM
Total Financing (USD)	-
Financing Sources	Multiple
Lead (Nodal) Govt Agency	Department of Energy (DoE)

Implementation Entity	Public and Private Sector
Implementation Timeframe	2021- 2030
Status	Activities under NERM are categorised as implemented, ongoing, and proposed.
Policy Initiatives	National Energy Road Map (NERM):2016-2030 and NERM-IP; Rural Electrification NAMA; National Green Energy Fund (NGEF); Renewable Energy Electrification Master Plan for Vanuatu; Vanuatu Coconut Strategy 2016-2025
Risks (Barrier/Challenges)	Capacity and Regulatory Barriers and Lack of Incentive system
Status as on December 2024	

NDC Action/Measure: 3- Improve transport (land and marine) Energy Efficiency	
Description	The NERM 2016-2030 identifies transportation as an important mitigation sector, and the overall identified mitigation action is improving energy efficiency with new efficient vehicles, improved maintenance, behaviour change, improved road infrastructure, etc
Objectives	Improving Energy Efficiency in the transportation sector
Output	Reduced GHG Emissions
Outcome	10% improvement in transport energy efficiency by 2030
GHG Emissions Reductions	9.86 Gg CO_2e/Year
NSDPs Impact	ECO 2.4, ECO 2.7
SDGs Impacts	SDG 7, SDG 9, SDG 11, SDG 13
Cost (USD)	Budgeted under NERM
Total Financing (USD)	-
Financing Sources	Multiple
Lead (Nodal) Govt Agency	Department of Energy (DoE)
Implementation Entity	Public and Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	National Energy Road Map (NERM):2016-2030 and NERM Implementation Roadmap
Risks (Barrier/Challenges)	Financial, Infrastructure, Information and awareness
Status as on December 2024	

NDC Action/Measure: 4- Electric Vehicles (e-Mobility)	
Description	Globally, e-mobility is expanding significantly as an alternative to conventional fossil fuel-based transportation systems. This NDC action aims to introduce Electric Vehicles (EVs) initially for the public transportation in main populated areas (Port Vila and Luganville) and further, personal transportation in urban areas e.g., Port Vila which has more focus on cars and mini bus.

Objectives	a) Introduce Electric Vehicles (e-buses) for public transportation (10% of total Public Buses); (b) Introduce Electric Cars (e-Cars) in Vanuatu (10% of government fleet); and (c) 1000 Electric Two wheelers (e-bikes) /Three Wheelers (e-rickshaw)
Output	Reduced GHG Emissions, traffic congestions and reduced pollution
Outcome	Reduced dependence on Fossil fuels and with the increasing penetration of renewable energy (solar) systems in grid, connecting EVs to the grid would help with the storage problem and would support effective and efficient grid management.
GHG Emissions Reductions	2.61 Gg CO2e/Year
NSDPs Impact	SOC 2.4, SOC 6.6, ENV 2.1, ENV 2.3, ECO 2.6
SDGs Impacts	SDG 7, SDG 9, SDG 11, SDG 13
Cost (USD)	4.25 million USD
Total Financing (USD)	-
Financing Sources	Multiple
Lead (Nodal) Govt Agency	Department of Energy (DoE)
Implementation Entity	Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	National Energy Road Map (NERM):2016-2030 and NERM Implementation Roadmap
Risks (Barrier/Challenges)	Infrastructure, regulatory barriers and lack of incentive systems
Status as on December 2024	

NDC Action/Measure: 5- 20 % Bio-diesel (bio-fuel) Blending in Diesel	
Description	Bio-diesel can be manufactured from the copra-oil and used in the internal combustion engines and the pilot projects in the Pacific have been implemented. This NDC action aims at further exploring the potential blending of Coconut oil in Diesel for transportation.
Objectives	20% Bio-diesel blending in Diesel by 2030
Output	Reduced GHG Emissions
Outcome	Reduced Diesel consumption and maximise returns to farmers from their coconut crop. Improvement in social economic condition of farmers and farm worker.
GHG Emissions Reductions	18.50 Gg CO2e/Year
NSDPs Impact	SOC 2.4, SOC 6.6, ENV 2.1, ENV 2.3, ENV 4.6, ENV 4.7, ECO 2.1, ECO 2.4, ECO 2.6, ECO 3.1, ECO 4.3
SDGs Impacts	SDG 7, SDG 8, SDG 11, SDG 13
Cost (USD)	1.25 million USD
Total Financing (USD)	-

Financing Sources	Multiple
Lead (Nodal) Govt Agency	Department of Energy (DoE)
Implementation Entity	Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	National Energy Road Map (NERM):2016-2030 and NERM Implementation Roadmap; Vanuatu National Coconut Strategy 2016-2025
Risks (Barrier/Challenges)	Regulatory barriers
Status as on December 2024	

NDC Action/Measure: 6-Milage and Emission Standards for Vehicles	
Description	The road transport vehicles are imported in Vanuatu (mostly refurbished vehicles from developing countries) and are not subjected to mileage and emissions standard. Although the Land Transport Authority regulations provide for vehicle inspections to confirm roadworthiness, they do not define emission standards (emission ratings). The transport laws do not provide standards for fuel specifications and emission standards from exhaust fumes. Hence, it is necessary to adopt mileage and emissions standard in Vanuatu.
Objectives	Adopt specific mileage norms and tailgate exhaust standards
Output	Reduced GHG Emissions
Outcome	Reduced Fossil fuel consumption and air improved air quality
GHG Emissions Reductions	0.29 Gg CO2e/Year
NSDPs Impact	ECO 2.6
SDGs Impacts	SDG 7, SDG 8, SDG 13
Cost (USD)	0.50 million USD
Total Financing (USD)	---
Financing Sources	Multiple
Lead (Nodal) Govt Agency	Department of Energy (DoE)
Implementation Entity	Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	National Energy Road Map (NERM):2016-2030; National Environment Policy & Implementation Plan 2016 - 2030
Risks (Barrier/Challenges)	Infrastructure and Regulatory barriers

Status as on December 2024	

NDC Action/Measure: 7- Biogas plants for commercial and residential use (1,000 plants)	
Description	Use of biogas/biogas plants for commercial and residential use would be an important measure for promoting clean cooking in Vanuatu.
Objectives	Installing 1000 Biogas plants by 2030
Output	Reduced GHG Emissions
Outcome	Reduced reliance on LPG and fuelwood for cooking needs as well as abatement of GHG emissions from the waste and livestock sector via modern management of livestock waste.
GHG Emissions Reductions	3.50 Gg CO2e/Year
NSDPs Impact	SOC 2.4, SOC 6.4, ENV 2.1, ECO 2.1, 4.5
SDGs Impacts	SDG 3, SDG 7, SDG 8, SDG 11, SDG 13
Cost (USD)	10 million USD
Total Financing (USD)	-
Financing Sources	-
Lead (Nodal) Govt Agency	Department of Energy (DoE)
Implementation Entity	Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	National Energy Road Map (NERM):2016-2030 and NERM Implementation Roadmap
Risks (Barrier/Challenges)	Financial, Capacity and Awareness
Status as on December 2024	

NDC Action/Measure: 8- Energy Efficiency in Commercial and Residential Sector	
Description	Energy efficiency in Commercial and Residential sector is an important GHG mitigation measures. The DoE has already initiated various measures to enhance energy efficiency across the demand-side sectors. Vanuatu has already placed energy labelling for selected electric equipment. This NDC action also envisages to introduce the concept of green buildings in Vanuatu.
Objectives	1. Achieve 5% of Energy Efficiency in Commercial and Residential Sector commission by 2030. 2. 10 numbers of Energy Efficient Building (Green Building) by 2030
Output	Reduced GHG Emissions

Outcome	Improved Energy and Resource efficiency in commercial, residential and Construction sector
GHG Emissions Reductions	0.35 Gg CO2e/Year
NSDPs Impact	SOC 6.6, ENV 2.3, ECO 2.3, ECO 2.4
SDGs Impacts	SDG 7, SDG 8, SDG 13
Cost (USD)	0.75 million USD
Total Financing (USD)	-
Financing Sources	---
Lead (Nodal) Govt Agency	Department of Energy (DoE)
Implementation Entity	Public and Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	National Energy Road Map (NERM):2016-2030; National Environment Policy & Implementation Plan 2016 - 2030
Risks (Barrier/Challenges)	Financial, Capacity and Awareness, Regulatory barriers
Status as on December 2024	

NDC Action/Measure: 9- Ecotourism Supported by Local Communities	
Description	Tourism is an important sector for Vanuatu's economy and by supporting/emphasizing ecotourism Vanuatu can attract, target responsible and high-value tourists who appreciate Vanuatu for its natural beauty, the way of life that some islanders practice (emphasizing immaterial, rather than material, values) and its efforts to preserve natural assets for future generations. Also, it is estimated that 27% of the income from tourism revenue is used for procuring goods and services from abroad which have higher carbon footprint due to longer transport distance.
Objectives	1. Reduce dependence on import of good and services from abroad 2. Support local production and packaging as they tend to low carbon footprint, support local communities and avoid use of plastic.
Output	Reduced GHG Emissions and waste minimization
Outcome	Positive impact on ecosystem and improved income for farmers and local communities involved in tourism
GHG Emissions Reductions	Not Estimated
NSDPs Impact	SOC 1.3, ENV 1.3, ENV 5.1, ECO 1.5, ECO 2.4, ECO 3.1, ECO 3.2, ECO 3.4, ECO 4.1, ECO 4.3, ECO 4.4
SDGs Impacts	SDG 8, SDG 11, SDG 13
Cost (USD)	0.25 million USD

Total Financing (USD)	-
Financing Sources	-
Lead (Nodal) Govt Agency	Department of Tourism (DoT)
Implementation Entity	Public and Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	National Energy Road Map (NERM):2016-2030; National Sustainable Tourism Policy
Risks (Barrier/Challenges)	Financial, Capacity and Awareness, Regulatory barriers
Status as on December 2024	

NDC Action/Measure: 10- Training and capacity building for livestock farming and pasture management	
Description	With this enhanced NDC measure, the MALFFB would be able to build the capacities of livestock farmers on sustainable livestock farming practices including creating access to suitable technological and economical support for improving pasture management practices.
Objectives	Build capacities of livestock farmers on sustainable livestock farming practices
Output	Potential to reduce 5-25% from the Baseline Scenario
Outcome	Improved access to technology and economic support
GHG Emissions Reductions	Not Estimated
NSDPs Impact	SOC 2.4, ENV 4.6 and ENV 4.7
SDGs Impacts	SDG 2, 4 and 8
Cost (USD)	0.35 million USD
Total Financing (USD)	---
Financing Sources	---
Lead (Nodal) Govt Agency	Ministry of Agriculture, Livestock, Forestry, Fisheries and Biosecurity (MALFFB)
Implementation Entity	Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	Sustainable Livestock Farming
Risks (Barrier/Challenges)	, Capacity and Awareness, Technical and Financial Barriers
Status as on December 2024	

NDC Action/Measure: 11 (Circular Economy Strategy) - Converting Pastures to Silvopastural Livestock Systems	
Description	Silvopastoral livestock systems combine forestry activities with livestock grazing. This intervention aims for converting pastures to silvopastoral livestock systems by planting trees on grassland and through financial incentives.
Objectives	1. This intervention will lead to increase forest carbon on pastured by planting trees on grassland. 2. Shall increase livestock productivity
Output	Increased overall revenue per hectare of land
Outcome	Restoration of degraded grasslands can still help increase soil organic carbon
GHG Emissions Reductions	30.977 Gg CO2eq/year
NSDPs Impact	ENV 4.1, ENV 4.6, ENV 4.7, ENV 5.2, ECO 2.5, ECO 3.1
SDGs Impacts	SDG 2, SDG 8, SDG 13
Cost (USD)	0.50 million USD
Total Financing (USD)	---
Financing Sources	---
Lead (Nodal) Govt Agency	Ministry of Agriculture, Livestock, Forestry, Fisheries and Biosecurity (MALFFB)
Implementation Entity	Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	Livestock and Pasture Management Policy
Risks (Barrier/Challenges)	Capacity, Regulatory barriers and Lack of Incentive system
Status as on December 2024	

NDC Action/Measure: 12 (Circular Economy Strategy) - International Collaboration to Improve Livestock Efficiency	
Description	This NDC action aims at seeking international cooperation that can help identify viable options for reducing GHG emission from livestock in Vanuatu
Objectives	Identify measures that could be relevant to Vanuatuan context
Output	Reduction in GHG Emissions
Outcome	Increased livestock productivity
GHG Emissions Reductions	Not Estimated
NSDPs Impact	ECO 4.9

SDGs Impacts	SDG 2, SDG 8, SDG 13, SDG 17
Cost (USD)	0.50 million USD
Total Financing (USD)	---
Financing Sources	---
Lead (Nodal) Govt Agency	Ministry of Agriculture, Livestock, Forestry, Fisheries and Biosecurity (MALFFB)
Implementation Entity	Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	Livestock and Pasture Management Policy
Risks (Barrier/Challenges)	Capacity, Regulatory barriers and Lack of Incentive system
Status as on December 2024	

NDC Action/Measure: 13 - Waste to Energy Plant for Municipal Solid Waste (MSW)	
Description	The waste to energy plant in Vanuatu is envisaged to establish a sustainable solid waste management (SWM) system for the municipal area of Port Villa, Luganville and Lenakel and its neighbouring outer islands.
Objectives	1. Developing treatment (proven waste-to-energy [WTE] technology), recycling, and disposal infrastructure 2. Strengthening institutional capacities for sustainable solid waste services delivery and environmental monitoring 3. Improving public awareness on WTE and reduce-reuse-recycle (3R)
Output	Reduce disaster risk and improve climate change resilience, while creating a cleaner environment and decreasing GHG emissions
Outcome	Contribute to electrification in grid-connected areas and would improve public and environmental health, especially ocean health.
GHG Emissions Reductions	14.85 Gg CO2e/ Year
NSDPs Impact	SOC 3.2, SOC 6.5, ENV 2.1, ENV 2.2, ENV 2.3, ENV 2.4, ENV 2.5, ENV 3.1, ENV 5.6, ECO 2.1
SDGs Impacts	SDG 7, SDG 8, SDG 11, SDG 12, SDG 13
Cost (USD)	100 million USD
Total Financing (USD)	--
Financing Sources	---
Lead (Nodal) Govt Agency	Department of Environment
Implementation Entity	Private Sector

Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	Waste Management Strategy (recommended)
Risks (Barrier/Challenges)	Financial, Capacity and Regulatory barriers
Status as on December 2024	

NDC Action/Measure: 14 (Circular Economy Strategy)- Compost municipal organic waste to produce soil enhancer	
Description	Households in Vanuatu produce an estimated 27,000 tonnes of organic waste, which makes up close to 80% of waste volumes in some cities. This NDC action intends for composting municipal organic waste for producing soil enhancer
Objectives	To compost 60% of organic waste, which reduces methane emissions from landfills
Output	Reduced GHG Emissions and waste minimization
Outcome	Reduction in volume of waste being diverted from Landfills
GHG Emissions Reductions	10.94 Gg CO2e/ Year
NSDPs Impact	SOC 6.5, ENV 1.1, ENV 1.5, ENV 2.4, ENV 2.5, ENV 3.1
SDGs Impacts	SDG 11, SDG 12, SDG 13
Cost (USD)	1.50 million USD
Total Financing (USD)	---
Financing Sources	---
Lead (Nodal) Govt Agency	---
Implementation Entity	Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	Waste Management Strategy (recommended)
Risks (Barrier/Challenges)	Financial, Capacity and Regulatory barriers
Status as on December 2024	

NDC Action/Measure: 15 (Circular Economy Strategy)- Collect, Sort and Export Recyclable Materials (indicative) for first phase for Port Vila	
Description	This intervention intends to scaling up collection, sorting, export and use of recyclable materials as generally they have a lower carbon footprint and thus reduces the dependence on international suppliers to reduce packaging waste.

Objectives	1. To improve the collection of recyclable materials 2. Minimize the import of packaging material
Output	Reduced greenhouse gas emissions through the diversion of waste from the landfill
Outcome	Reduction in volume of waste being diverted from Landfills; Increase in Job opportunities
GHG Emissions Reductions	Not Estimated
NSDPs Impact	ENV 2.4, ENV 3.4, ECO 1.2, ECO 2.5, ECO 4.5
SDGs Impacts	SDG 11, SDG 12, SDG 13
Cost (USD)	1 million USD
Total Financing (USD)	---
Financing Sources	---
Lead (Nodal) Govt Agency	Department of Environment
Implementation Entity	Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	Waste Management Strategy (recommended)
Risks (Barrier/Challenges)	Financial, Capacity and Regulatory barriers
Status as on December 2024	

NDC Action/Measure: 16 (Circular Economy Strategy)- National Plastics Strategy	
Description	Vanuatu has introduced an import ban on a range of single-use plastics and has already started restricting the import of products and materials which the country's current waste management system cannot adequately process. Additionally, the country has levied import duties on some carbon intensive materials, but not all.
Objectives	1. Reduce the import of plastics with 50% by 2030. 2. Discourage the import of products which create serious waste issue in the country.
Output	Reduced upstream emissions from the production of plastic products.
Outcome	Revenues from these duties could be invested in developing of sustainable local alternatives and strengthening waste collection and processing.
GHG Emissions Reductions	Not Estimated
NSDPs Impact	ECO 1.2, 4.4
SDGs Impacts	SDG 11 and 12
Cost (USD)	0.25 million USD

Total Financing (USD)	---
Financing Sources	---
Lead (Nodal) Govt Agency	Department of Environment
Implementation Entity	Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	National Plastic Waste Policy (recommended)
Risks (Barrier/Challenges)	Regulatory barrier
Status as on December 2024	

NDC Action/Measure: 17- Waste Water Management System in Vanuatu	
Description	Wastewater is generated primarily by sanitation systems and domestic and commercial activity, largely handled by decentralized or open septic systems. Lacking an adequate waste water management system, GHG emissions from this subsector are increasing due to population growth and urbanization and poses serious health and environmental risks.
Objectives	1. Centralised Waste water collection and treatment system in municipal area including awareness and capacity building 2. Improvements to Public and Communal Toilet Facilities including Bio- Toilets
Output	Reduced GHG Emissions
Outcome	Effective Wastewater Management systems will lead to Improved hygiene and Sanitation
GHG Emissions Reductions	14.85 Gg CO2e/ Year
NSDPs Impact	SOC 3.3, SOC 6.5, ENV 2.4, ENV 4.2, ENV 4.4, ENV 4.7, ECO 2.2
SDGs Impacts	SDG 6, 11 and 14
Cost (USD)	100 million USD
Total Financing (USD)	---
Financing Sources	---
Lead (Nodal) Govt Agency	Department of Environment
Implementation Entity (Public/Private Sector)	Private Sector
Implementation Timeframe	2021- 2030
Status	Proposed
Policy Initiatives	National Waste Water Policy

Risks (Barrier/Challenges)	Infrastructure and Regulatory Barriers
Status as on December 2024	

Assessment of Achievement of NDC targets

To be updated

Mitigation policies and measures, actions and plans

The following sections provide a comprehensive overview of the various mitigation actions that have been implemented, are currently ongoing, or are planned for implementation within the energy, agriculture, and waste sectors. The GHG emission reductions are provided in metric tons.

Mitigation actions under NERM

Vanuatu's National Energy Roadmap (NERM) 2013-2020 was published in 2013 and provided the vision "To energise Vanuatu's growth and development through the provision of secure, affordable, widely accessible, high quality, clean energy services for an Educated, Healthy, and Wealthy nation." The five energy sector priorities were access, petroleum supply, affordability, energy security, and climate change.

The updated NERM 2016-2030 was completed and launched in 2016. It has identified five strategic areas for policy intervention in the energy sector, which include:

- Accessible energy,
- Affordable energy,
- Secure and reliable energy,
- Sustainable energy and
- Green Growth.

Over the past years, various stakeholders have been working intensively on the preparation and implementation of a number of activities. The following table lists all activities which have been finalised and have provided contributions to the NERM targets.

Table 3: NERM projects finalized

INVESTMENT/ACTION	MAIN OUTCOME(S) IT CONTRIBUTES TO	LEAD RESPONSIBILITY	UPDATE
UNDINE BAY SOLAR PV SYSTEM (510KW)	Access, sustainability, green growth	UNELCO	Completed [2016]
GPOBA GRID BASED ELECTRICITY PROJECT	Access	DoE, World Bank, UNELCO and VUI	Completed [2019]
THE LIGHTING OF LUGANVILLE TOWN STREETS	Access	VUI	Completed
NORTH EAST MALEKULA RURAL ELECTRIFICATION PROJECT	Access	GoV, EU, UNELCO	Completed [2017]
KAWENE 1.5MW GRID-CONNECTED SOLAR FACILITY, EFATE (ENERGY FACILITY 2)	Sustainability	GoV, EU, UNELCO,	Completed [2018]

LOLTONG HYDRO PROJECT, NORTH PENTECOST	Access, sustainability, green growth	Governments of New Zealand, Australia, and Vanuatu	Completed [2016]
PREPARE A DETAILED DESIGN FOR, AND ESTABLISH, A NATIONAL GREEN ENERGY FUND,	Access, sustainability, green growth	DoE, MFEM, NGEF Taskforce, GGGI	Completed [Phase One: 2018]
RURAL BIOGAS PROJECT FOR ONESUA PRESBYTERIAN COLLEGE AND AGRICULTURE COLLEGE	Access, sustainability, green growth	EU, GIZ DoE,	Completed [2019]
PILOT SOLAR REFRIGERATION FOR RURAL BUNGALOWS	Access, green growth	Government of Germany (BMZ), GGGI, DoE, DoT, Skills Program	Completed [2017]
INTRODUCE MANDATORY STANDARDS AND LABELING SYSTEM (MEPS) FOR REFRIGERATORS, FREEZERS, AIR CONDITIONING, AND LIGHTING THROUGH PARLIAMENTARY APPROVAL OF THE ENERGY EFFICIENCY OF ELECTRICAL APPLIANCES, EQUIPMENT AND LIGHTING PRODUCTS BILL	Sustainability, affordability	DoE	Completed [2017]
INCORPORATE MEPS INTO GOVERNMENT PROCUREMENT POLICIES FOR APPLIANCES AND VEHICLES	Sustainability, affordability	DoE & Dept. of Finance and Treasury	Completed [2018]
RETENDER THE LUGANVILLE CONCESSION AGREEMENT	Affordability, security, and reliability	DoE	Completed [2019]
DEVELOP AN ELECTRIFICATION PLAN FOR RENEWABLE ENERGY IN REMOTE ISLANDS	Access, sustainability, green growth	GIZ	Completed [2017]
UNDERTAKE MARKET DEMAND ASSESSMENT FOR THE NGEF	Access, sustainability, green growth	DoE, GGGI	Completed [2018]
CARRY OUT JOINT PLANNING SESSIONS BETWEEN DIFFERENT MINISTRIES TO IDENTIFY KEY ENERGY SECTOR ACTIVITIES THAT CAN CONTRIBUTE TO OBJECTIVES IN OTHER SECTORS (MOU WITH MINISTRY OF HEALTH)	Green growth	DoE and other government agencies	Completed
DEVELOP A STRATEGIC AND WORKING PARTNERSHIP ARRANGEMENT WITH THE DEPARTMENT OF RURAL WATER SUPPLY SO THAT IT IS COORDINATED AND PARALLEL ROLLOUT OF BOTH ELECTRICITY AND WATER PROJECTS THROUGHOUT THE COUNTRY (MOU WITH MINISTRY OF LANDS)	Green growth	DoE and Dept. of Rural Water Supply	Completed
SUPPORT DEPARTMENT OF TOURISM AND AGRICULTURE TO PROMOTE THE USE OF SOLAR TECHNOLOGIES IN THESE SECTORS	Green growth, access	DoE, DoA, Dept. of Tourism, GGGI	Completed
SOLAR PV MICRO-GRID FOR WINTUA AND LORLOW COMMUNITIES ON MALEKULA ISLAND	Access, sustainability, green growth	DoE, Austrain Government	Completed 2020

Planned Mitigation Interventions under the NERM

Various interventions are planned under the NERM and are provide under the below table:

Table 4: Activities Planned under Accessible Energy

Accessible Energy				
MITIGATION ACTION	**NATURE OF ACTION & COVERAGE**	**PROGRESS INDICATORS**	**OBJECTIVES OF ACTION**	**STATUS OF IMPLEMENTATION**

EXTENSION OF GLOBAL PARTNERSHIP ON OUTPUT BASED AID (GPOBA) GRID-BASED ELECTRICITY ACCESS PROJECT	Grid extension, Concession areas	Number of additional households connected to grid	The GPOBA provided one-off subsidies to assist low-income households to connect to the existing electricity grid in concession areas in Port Vila, Tanna, Malekula and Luganville. A continuation of the project is suggested, funding has not been secured. A minimum of additional 1,000 households needs to receive electricity access to achieve the NERM targets.	Proposed
BARRIER REMOVAL FOR ACHIEVING THE NATIONAL ENERGY ROAD MAP TARGETS OF VANUATU (BRANTV)	Off-grid rural electrification, Pan Vanuatu	Number of rural community households having access to electricity	2,000 households will gain access to village-scale power systems or to family compound-scale Nano- grids installed in all compounds in a village. Project is fully financed and activities started. Work will end in 2022. It is important to note that there will be 20 hydro sites, equating to (approx. 50 HH*20 villages) households which will have access onto the mini-grid, while the other 1000 will have access to community-based or Nano/compound-based solar systems in terms or incremental or productive use, but no house connections.	Under Implementation
WINTUA/LORLOW SOLAR PV MINI-GRID	Off-grid rural electrification, South West Bay, Malekula	Number of rural community households having access to electricity	Under the Wintua/Lorlow mini-grid funded through NAMA facility, around 75 households and 14 public buildings will be electrified. The project is fully financed and construction is completed.	Commissioned and Operational

AMBRYM MINI-GRID	Off-grid rural electrification, Ambrym	Number of rural community households having access to electricity	Erection of 2 solar PV mini-grids on Ambrym island, connecting around 160 households to the grid. The concept will be handed in at GCF SAP proposal go be submitted to GCF in 2019.	Proposed
DISTRIBUTED ENERGY GENERATION	Electrification of unelectrified households in concessional areas	Number of additional households having access to electricity in concessional areas	DoE is interested to explore the option of using the "Distributed Energy Generation" by installing micro/mini-grids in concession areas (Efate, Santo, Malekula & Tanna) in locations where grid extension is hard to reach or very expensive. Once the grid penetration is achieved eventually the micro/mini- grids could be integrated on to the main grid.	Proposed
ELECTRIFICATION OF ALL EDUCATIONAL AND HEALTH CENTRES BY 2022	Electrification of unelectrified health centres in outer islands of Vanuatu	Number of rural health centres having access to electricity	DoE is keen to launch a program similar to VREP focusing on electrification of all education and health centres in Vanuatu by 2022. The idea is to have a targeted approach to electrify on one of the key sub-sectors (Schools & Health centres) and replicate the approach across other sub-sectors.	Proposed
Accessible Energy				
MITIGATION ACTION	**NATURE OF ACTION & COVERAGE**	**PROGRESS INDICATORS**	**OBJECTIVES OF ACTION**	**STATUS OF IMPLEMENTATION**
CONVERSION OF DIESEL GENERATORS ON TANNA	Energy efficiency improvement, concessional areas	Percentage of coconut oil blending achieved	Existing diesel generators should be converted to make sure coconut oil can be used for electricity generation.	Proposed

INVESTMENT IN BARGE	Fuel Distribution, Pan Vanuatu	Number of barges built	Invest in a barge to improve the efficiency and reliability of fuel distribution within Vanuatu by shifting away from deliveries of fuel in drums and towards the use of regular bulk deliveries to outer islands.	Under implementation
Sustainable Energy				
MITIGATION ACTION	**NATURE OF ACTION & COVERAGE**	**PROGRESS INDICATORS**	**OBJECTIVES OF ACTION**	**STATUS OF IMPLEMENTATION**
BRENWE 400 KW HYDRO POWER PROJECT	Renewable energy (hydro power) based electricity generation, Malekula	Kwh of electricity generated	The Brenwe Hydro Power project is a 400kW run-of-river hydropower plant on the island of Malekula. The project is currently being implemented financed through an ADB loan and contributions from the Government of Vanuatu. Completion is expected in 2022.	Under Implementation
SARAKATA 800 KW HYDRO POWER EXTENSION PROJECT	Renewable energy (hydro power) based electricity generation, Santo	Kwh of electricity generated	Preparation of the project is underway, currently, the feasibility study is being carried out. Funding through Japanese Grant for Projects envisaged, the project will also receive a contribution from the Government of Vanuatu. Commissioning is expected for 2023.	Under Implementation
TALISE 75 KW MICRO HYDRO POWER PROJECT	Renewable energy (hydro power) based electricity generation, Maewo	Kwh of electricity generated	This project is implemented through IUCN (International Union for Conservation of Nature) and funded by the Government of Austria and Italy with co-financing from the Government of Australia and Government of Vanuatu	Commissioned and Operational

REVISION OF ELECTRICITY SUPPLY ACT AND COCONUT FOR FUEL STRATEGY	Electricity sector Policy development to support achieving NERM targets, Pan Vanuatu	Policy endorsed by Council of Ministers and URA	Revision of the Electricity Supply Act is necessary to allow Independent Power Producers (IPPs) to erect grid-connected renewable energy projects. The Coconut for Fuel Strategy is a key component of the NDC Implementation Roadmap to secure a well-established agreement among all relevant stakeholders to provide coconut oil for electricity generation	Proposed
Green Growth				
MITIGATION ACTION	**NATURE OF ACTION & COVERAGE**	**PROGRESS INDICATORS**	**OBJECTIVES OF ACTION**	**STATUS OF IMPLEMENTATION**
Coconut for Fuel Strategy	Renewable energy sector Policy development to support achieving NDC targets, Concessional areas	Policy endorsed by Council of Ministers	The Coconut for Fuel Strategy is a key component of the NDC Implementation Roadmap to secure a well-established agreement among all relevant stakeholders to provide coconut oil for electricity generation.	Under Implementation
Coconut oil	Fuel blending/ replacement, Concessional areas	Volume of coconut oil used as fuel for electricity generation	Usage in Efate grid up to a maximum of 12.5 million litres (Option 1) or 6 million litres (Option 2) in 2030. Agreements between key stakeholders based on Coconut for Fuel Strategy.	Partly implemented on Efate grid
Expansion of VREP I and VREP II for bungalows	Renewable energy for tourism, Outer Islands	Number of tourism bungalows connected to RE electricity	Use the existing structure in the VREP program to supply RE equipment to remaining bungalows.	Partly implemented

Solar system for small and medium tourism operators	Renewable energy for tourism, Outer Islands	Number of tourism bungalows connected to RE electricity	It is estimated 43 off grid bungalows of 1-2-star rating require 0.4-1kW systems, of which 50% may take up an offer. This would total approximately 12kW of demand or $120,000 worth at $10,000/kW. NGEF may provide 80% debt to 20% other finance from the owner or developer.	Proposed

Circular Economy Mitigation Opportunities in Vanuatu

Economic growth is often accompanied by a gradual decrease in the quality of ecosystems and a gradual deterioration of natural assets such as soils, marine environments, fish and forests. By redefining development from a systems perspective, governments can grow their infrastructure and building stock and meet society's needs, while moving away from the linear economic model that places long-term development ambitions at risk.

The systems approach outlined for Vanuatu departs from a focus on a single sector or industry. It even departs from defining the country's ability to influence emissions only within its national borders. Rather, it defines collaborative strategies to develop a circular economy along domestic and international value chains that are aligned with national objectives to safeguard natural assets, avoid waste and reduce greenhouse gas (GHG) emissions.

This way of thinking opens new avenues for Vanuatu to take action on its climate ambitions and commitments under the Paris Agreement and align these with its efforts to achieve the Sustainable Development Goals (SDGs), which relate to primary resource extraction and waste. This approach redefines development and growth, viewing them through the lens of metabolic efficiency and inspired by nature, where waste does not exist.

Identifying complementary GHG mitigation opportunities through the circular economy is part of an effort to further enhance Vanuatu's Nationally Determined Contribution (NDC) or its mitigation pledge under the Paris Agreement.

Efforts to enhance the NDC's ambition already consider a range of interventions that, together, aim to reduce national GHG emissions by 82,685 tCO_2e by 2030, when considering all sectors except livestock. The measures already considered aim to expand renewable energy capacity, vehicle efficiency and electrification, and biodiesel blending.

Consumption in Vanuatu is 59 percent circular

Resource use for consumption in Vanuatu is estimated to be 59 percent circular. This means that the country relies on secondary or renewable materials and energy sources for 59 percent of the materials used for domestic consumption. The remaining 41 percent of material use is not circular and can be described as following a linear 'take- make-waste' trajectory. Those

materials are mostly of foreign origin and collide with the country's development ambitions because they create waste disposal problems and contribute to the deterioration of natural assets resulting from the pollution of soils, surface waters and marine environments.

However, the country can address these issues effectively because its population is directly exposed to and well- aware of the adverse impacts of pollution. The government is already prioritizing the conservation of natural assets for future generations over short-term gains. Circular economy analytics can identify the opportunities that contribute to that objective, as it aims to avoid waste and reduce the extraction of primary resources. Vanuatu is already more circular than any other country whose circularity has been estimated. With domestic consumption estimated to be 59 percent circular, it far exceeds the global average of 8.6 percent, Austria's 9.7 percent and the Netherlands' 24.5 percent. The country plans to make its power production fully renewable, has imposed bans on the extraction of minerals near vulnerable coastlines, and seeks international cooperation to reduce GHG emissions from livestock and more closely monitor the development of fish stocks to avoid excessive extraction. All these ambitions will make Vanuatu even more circular.

Circular economy opportunities in Vanuatu

This concise analysis aims to be solution-oriented by identifying circular economy opportunities across sectors that are aligned with the development ambitions of the Government of Vanuatu and the people who live in the country. Taken together, the circular economy opportunities proposed here can help avoid, between today and 2030, around 44 percent of solid waste, decrease primary resource extraction and reduce the trade deficit. They would also reduce domestic GHG emissions by 10 percent, or by 44 percent when taking into account only emissions from non-livestock sectors. When taking a consumption- based approach to allocating emissions, they also reduce foreign emissions in the value chains for products imported into Vanuatu by 18 percent.

The main opportunities involve:

- Converting grassland to silvopastoral livestock;
- Applying anaerobic digestion for municipal, industrial and agricultural organic waste. This will divert organic waste from landfills and produce both biogas and soil enhancers.
- Where volumes are too small for a biogas plant, or where the emphasis is on producing a good soil enhancer rather than producing biogas, composting can be used instead.
- Collaborating with development partners

Applying the circular economy concept to drive greenhouse gas mitigation

Vanuatu is on the frontlines of climate change. It is highly exposed to its impacts change, even as the country adopts policy measures that will help preserve natural assets and keep GHG emissions per capita low. With an annual per capita material footprint of 6.1 tonnes and a per capita carbon footprint of 2.1 tCO_2e, Vanuatu's population already maintains a small carbon and material footprint.5 Furthermore, reports suggest that the country's people rank among the happiest in the world.

Vanuatu's 80 islands have chosen to depart from the traditional development pathway, where the use of large amounts of carbon-intensive materials helps build infrastructure, assemble

stocks of consumer goods and provide material wealth. Instead, Vanuatu prioritizes its national resources and seeks to further advance national well-being without increasing material consumption and thereby avoid associated environmental impacts. The circular economy can guide the country in reducing its material impact even further, also targeting also the remaining 41 percent of material use for consumption that is still linear and that threatens the country's natural asset base, such as its fishing stocks, forests and soils.

The circular economy is an economic concept that aims to decouple economic growth from resource use, making material use regenerative, and minimize the use of finite, non-renewable resources. It does so by optimizing the use of existing assets and materials, thus reducing the use of primary materials and lowering the output of harmful wastes. By focusing on what is already available and altering the design of new products and assets, the circular economy concept can help Vanuatu define a development pathway that diversifies its economy, avoids waste and meets the needs of its inhabitants without degrading its natural assets.

The strategy of avoiding the depletion and degradation of natural assets aligns well with the country's goal to develop as a 'blue economy.' In a blue economy, economic development and policies focus on the sustainable use of oceanic resources, based on the notion that these resources are finite and vulnerable to anthropogenic activities. This requires fisheries to be managed sustainably and fishing activities to be monitored,8 preserving ecosystem health and avoiding pollution. The sustainable management of ocean resources also calls for an unprecedented level of collaboration across nation-states and between the public and private sectors,9 as pollution travels great distances in a marine environment. Collaboration, sustainable extraction levels and avoiding pollution are also the fundamentals of a circular economy.

This analysis of circular economy opportunities for Vanuatu seeks to help reduce the waste flow of imported materials, while also examining how to improve the resource efficiency of all material use, including domestically-sourced materials. The analysis focuses on materials with a relatively large carbon footprint. Where they include imported goods and materials, their reduction will also help to decrease emissions in other countries. Understanding the flow of materials and identifying where materials and products can be reduced, re-used and recycled reveals the most promising circular economy opportunities. Like a living organism, a country's population needs clean air to breathe, healthy food and clean water to live, energy for thermal comfort, and mobility and materials to deliver houses, vehicles and other consumer goods. Mapping a country's 'metabolic system' helps us understand how it uses material resources to deliver valuable services – such as nutrition, shelter and mobility – to its residents and identify opportunities for improvement. Finally, the circular economy can help Vanuatu communicate how it has consistently chosen an alternative to the linear development pathway and takes responsibility for future and past generations, as well as for the lives of those on distant shores.

The main circular economy opportunities and their ability to reduce greenhouse gas emissions and avoid solid waste involve:

- Converting grassland to silvopastoral livestock;
- Applying anaerobic digestion for municipal, industrial and agricultural organic waste. This will divert organic waste from landfills and produce both biogas and soil enhancers. Where volumes are too small for a biogas plant, or where the emphasis is

on producing a good soil enhancer rather than producing biogas, composting can be used instead.

- Collaborating with development partners to develop circular procurement to reduce waste, resource extraction and GHG emissions associated with investments;
- Aligning Vanuatu's tax regime with its development ambitions, increasing government revenue by taxing pollution and using these revenues to support the transition to a circular economy; and,
- Collecting and sorting recyclable materials and exporting those that cannot be used or processed domestically.
- To develop circular procurement to reduce waste, resource extraction and GHG emissions associated with investments;
- Aligning Vanuatu's tax regime with its development ambitions, increasing government revenue by taxing pollution and using these revenues to support the transition to a circular economy; and,
- Collecting and sorting recyclable materials and exporting those that cannot be used or processed domestically.

GCF Prioritized Pipeline of Ideas

The GCF Prioritized Pipeline of Ideas is composed of:

1) proposals that are been fully endorsed by NAB and approved by the Council of Ministers;
2) draft concept notes that are already developed;
3) project ideas that could be implemented between 2019 to 2020; and
4) proposals that have identified appropriate implementing partners.

ID	Pipeline of Ideas A for potential mitigation proposals	GCF grant (US$)	PPF (US$)	Public	Private	CSO/NGO	Mitigation sector	Status*
Prioritized Idea Pipeline A								
AA3	Scaling-up climate-resilient agriculture, including diversified farming best practices and business models to enhance the resilience of Vanuatu's vulnerable	1,00,00,000	-	√	√	√	Agriculture	Idea - potential for Simplified Approval Process . To be aligned with other projects.
AA7	Climate change educational transformation, including gender-responsive training for K-13 teachers on climate change, curriculum upscaling (incl. innovative financial and business models for adaptation/mitigation), technical/vocational education and training and tertiary opportunities	1,00,00,000		√	√	√	Multisector (Education)	Idea
AA9	Climate proofing roads and river crossings	1,00,00,000		√	√		Transport	Idea - Possible links to Climate Information Services for Resilient Development project and New

								Zealand Agency for International Development project to develop climate and disaster Risk standards for infrastructure
AA11	Implementing a national sustainable tourism plan, incl. provincial sustainable tourism development plans and scaling up off-grid solar technologies for rural tourism operators	1,00,00,000		√	√		Transport Forestry	Department of Tourism (DoT) idea
AM1	Operationalizing the NGEF	1,00,00,000	15,00,000	√			Multisector	Concept Note (CN) by GGGI
AM2	Building resilience and accelerating off-grid rural electrification through renewables in Vanuatu	3,00,00,000		√	√	√	Energy	CN by UNDP
AM3	Increasing climate change resilience in Vanuatu by implementing forest sector mitigation (REDD+)	1,00,00,000		√	√	√	Forestry	Department of Forests (DoF) idea
AM4	Promoting CE initiatives (micro plastic recycling, glass as alternative aggregates, paper recycling) to enhance resilience	1,00,00,000		√	√	√	Waste	Waste Corporation idea
AR1	Enhance Vanuatu's ability to seek accreditation and direct access to the GCF via the fast-track accreditation process	6,50,000		√	√	√	Multisector	CN by GIZ, GGGI & National Designated Authority (NDA)
AR3	Readiness support for strengthening engagement with private sector	3,50,000		√	√	√	Multisector	CN by GIZ, GGGI & Vanuatu Business Resilience Council
AR5	Strengthening executing entities' (EEs) capacity to participate effectively in GCF activities (designing high quality concept note and approach to theory of change)	4,00,000		√	√	√	Multisector	Idea work with Pacific Islands Forum Secretariat (PISF)
AR7	National land use planning and policy environment (mapping of customary land boundaries and area strategic development plan)	4,00,000		√	√	√	Multisector	Customary Land & Port Vila Municipal Council idea
Prioritized Pipeline of Ideas B								
BA1	Community Conservation & Protected Areas Reach and Effectiveness for Local Resilience by upscaling best practices	3,80,00,000	15,00,000	√		√	Forestry	CN by UNEP - GCF project
BA2	Promoting the blue economy to strengthen coastal communities and business resilience (coral reefs, mangrove and seagrass protection)	1,00,00,000		√	√	√	Energy	Idea -could be absorbed by regional Blue Carbon project
BA3	Restore, conserve and manage primary and secondary forests degraded by invasive species, Cordia alliodora, Leucaena leucecephala (Cassis) and Merramia peltata, (Vine)	1,00,00,000		√	√	√	Forestry	Idea
BA4	Traditional canoes for low-carbon and sustainable sea transportation for remote islands	1,00,00,000		√	√	√	Transport	Idea
BA6	Private sector eco-tourism and CCDRR risk planning project	2,00,00,000		√	√	√	Energy (Tourism)	Idea
BA7	Safe havens for ships during cyclones and disaster (haul out facilities and cyclone moorings throughout islands and hydrographic survey)	2,00,00,000		√	√	√	Transport	Idea

BA9	Wastewater management, standards and testing facility (master plan, implement Port Vila catchment upgrade; quality and flows of water through flood and wastewater management, monitoring and regulations)	6,00,00,000		√	√	√	Waste	Idea
BA12	Implementing building codes and scaling up cyclone-proof buildings (houses, community centres, aid posts, schools) in remote communities	2,00,00,000		√	√	√	Energy	Idea
BM1	Promoting energy-efficient appliances, lighting and equipment in Pacific Island countries (regional)	1,00,00,000		√	√	√	Energy	CN
BM2	Promoting green building design and certification for public (schools, hospitals) and private sector (hotels, offices) facilities	1,00,00,000		√	√	√	Energy	Idea
BM3	Geothermal for renewable energy generation (exploration and production feasibility study)	20,00,00,000	15,00,000	√	√	√	Energy	Idea
BM4	Development and implementation of vehicle emission standards	1,00,00,000		√	√	√	Transport	Idea
BR1	Readiness support to develop a national energy efficiency strategy (standards and labelling programme and testing facility)	4,00,000		√	√	√	Energy	CN by DoE/GGGI
BR2	Readiness support for improved access to financial products and services (financial inclusion, insurance, credit facilities, digital products: e-payment, e-wallet, e-saving)	3,00,000		√	√	√	Multisector	Idea work with PIFS
BR3	Vanuatu engineered lumber plan feasibility study	1,00,000		√	√		Forestry	DoF idea

Summary of greenhouse gas emissions and removals

(To be included)

Projections of greenhouse gas emissions and removals, as applicable

(To be included)

IV. Information related to climate change impacts and adaptation under Article 7 of the Paris Agreement

National Circumstances, Institutional Arrangements & Legal Framework

Vanuatu, located in the South Pacific between Fiji, Solomon Islands, and New Caledonia, comprises a 1,300 km archipelago with a land area of 12,336 km², a 2,528 km coastline, and a 680,000 km² Exclusive Economic Zone. Known for its volcanic origin and active seismicity, the nation frequently experiences earthquakes and volcanic eruptions due to its position on the Pacific Ring of Fire. The country is highly vulnerable to climate risks, including rising sea levels, increased cyclone intensity, and coastal erosion, which threaten its infrastructure, ecosystems, and communities. Vanuatu declared a climate emergency in 2022 and ranked among the most affected by climate disasters, including Category 5 cyclones like Pam (2015) and Harold (2020). Rapid population growth, at 2.3% annually, raises energy demand and contributes to emissions, further intensifying climate vulnerability. Vanuatu's economy is service-driven, with agriculture and fisheries supporting livelihoods but contributing minimally to emissions. GDP declined by 1.6% in 2021 due to pandemic-related setbacks, though remittances and commodity exports helped counterbalance losses. Industrial activity remains volatile, yet growth is expected to stabilize at 3% annually by 2028. The nation's energy strategies under its National Energy Road Map and Enhanced Nationally Determined Contribution aim to reduce emissions, though transport remains a significant and rising emissions source, necessitating sustainable solutions aligned with Vanuatu's 2050 Low Emissions Development Strategy.

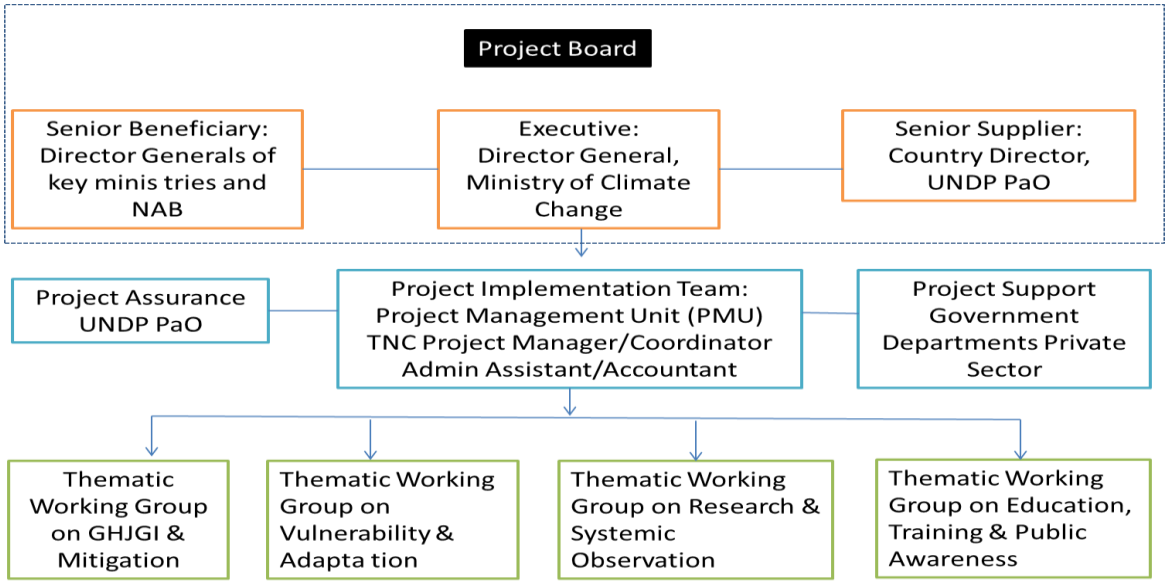
Vanuatu's low adaptive capacity is due to several factors. Limited resources hinder effective adaptation, with inadequate financial support for infrastructure improvements despite initiatives like the IRCC project. Top-down approaches often neglect local needs, reducing community engagement. Cultural factors, such as conflicts between local kastoms and adaptation strategies, also impede progress. Additionally, many communities lack institutional support, making adaptation planning difficult. Vanuatu's vulnerability to climate hazards, including sea-level rise and extreme weather, further exacerbates these challenges. Addressing these issues is key to enhancing resilience and improving adaptive capacity in the face of climate change. With limited adaptive capacity, Vanuatu ranks as the world's most at-risk country for natural hazards. Sea level rise and unsustainable practices like mangrove removal exacerbate coastal erosion, forcing relocations and damaging cultural sites, highlighting the severe socio-economic impacts.

Adaptive capacity

Vanuatu’s adaptive capacity to climate change is enhanced by community-based approaches, which have proven effective in addressing local vulnerabilities such as coastal erosion, water security, and flooding. These localized efforts foster community ownership, reduce administrative burdens on national bodies, and facilitate faster adaptation through simpler, direct action compared to top-down initiatives. By involving communities in the design and implementation of small-scale adaptation projects, these strategies empower local populations to manage their resources effectively and build resilience in agriculture, water management, and infrastructure. For instance, projects that support climate-resistant crop varieties and water harvesting systems have enabled Vanuatu’s rural communities to directly address climate-induced challenges with locally relevant solutions (Richmond & Sovacool, 2012). Vanuatu faces administrative constraints, particularly in reaching remote communities for implementing projects due to high travel costs and time constraints for public servants. Additionally, the availability of training in renewable energy systems remains low and is generally limited to initial installation phases without consistent follow-up or technical support. In terms of Financial Capacity, the dependency on external funding sources, highlighting that adaptation efforts are primarily supported through bilateral and multilateral development assistance. Initiatives like the Least Developed Countries Fund project and small-scale pilot projects on rainwater harvesting reflect reliance on international donors to cover adaptation costs. Community awareness initiatives are emphasized, focusing on improving climate change knowledge across villages, with educational kits disseminating key climate messages to rural and urban areas. Knowledge-sharing is facilitated through workshops and community-led informational resources, which help communities understand climate risks and adaptation strategies. community projects like rainwater harvesting systems, coastal defenses, and solar distillation plants, aiming to fortify water and infrastructure resilience against climate impacts. These measures include strengthening essential infrastructure like roads and bridges, particularly in areas susceptible to sea-level rise and storm surges, demonstrating Vanuatu's infrastructural adaptation strategies. Vanuatu has initiated pilot programs introducing climate-resilient crop strains, water desalination systems, and renewable energy for off-grid communities. Such projects are grounded in both traditional knowledge and new technologies, allowing Vanuatu to blend indigenous practices with advanced technologies to enhance resilience across sectors (Richmond & Sovacool, 2012).

Institutional, Legal and Policy Frameworks and Regulations

Figure 1: Institutional Arrangement and Organization Structure. Source: The Republic of Vanuatu Third National Communication



In Vanuatu, the National Disaster Management Office (NDMO), under the Ministry of Climate Change Adaptation, Meteorology and Geohazards, Environment, Energy, and Disaster Management, coordinates emergency responses and disaster management across the country. NDMO focuses on strengthening climate change and disaster networks at all levels (national, provincial, and local), mainstreaming climate change adaptation (CCA) and disaster risk reduction (DRR) in sectoral policies, improving risk awareness, and ensuring reliable communication. NDMO also fosters partnerships with stakeholders and works with communities to create Community Disaster Committees, enhancing resilience at both rural and urban levels (NDMO, 2022) (NAB, 2022).

The newly formed Department of Climate Change (DOCC) is responsible for coordinating and implementing adaptation and disaster risk management efforts. The DOCC plays a crucial role in mitigating the impacts of climate change in Vanuatu and also operates under the Ministry of Climate Change Adaptation, sharing responsibilities with the NDMO (DOCC, 2022).

The National Disaster Committee (NDC) is tasked with developing policies and strategies for disaster prevention, preparation, response, and recovery, ensuring their implementation by NDMO and other agencies. Similarly, the National Advisory Board (NAB) on Climate Change and Disaster Risk Reduction serves as the main body for policy development and advisory for CCA and DRR programs, overseeing information sharing, coordination, and climate finance processes (NAB, 2022).

The Vanuatu Meteorology and Geohazards Department (VMGD) acts as the National Meteorological and Hydrological Service (NMHS), providing essential forecasts, climate data, tsunami warnings, and climatological information through its six technical divisions (VMGD, 2022). The Department of Environmental Protection and Conservation (DEPC) and

Department of Energy (DOE) are also central in leading climate change mitigation, guiding energy policies, and overseeing sustainable development (DEPC, 2022) (DOE, 2022). The Vanuatu Humanitarian Team (VHT), funded by international organisations such as DFAT, the European Commission, and others, assists with humanitarian coordination, disaster preparedness, and response. It collaborates with a wide range of NGOs and international agencies such as Oxfam, Red Cross, UNICEF, and WHO (NDMO, 2022).

Private sector involvement is crucial to Vanuatu's disaster risk management. The Vanuatu Business Resilience Council (VBRC), the official private sector coordinator, helps build capacity to engage in DRR and climate change activities (VBRC, 2022).

Finally, the National Disaster Risk Management Act, first enacted in 2000 and revised after Tropical Cyclone Pam in 2016, establishes the institutional framework for disaster risk management. The Meteorology, Geological Hazards and Climate Change Act (2016) also outlines the forecasting and hazard management framework (Government of Vanuatu, 2019) (NDMO, 2022).

The Department of Environment and Climate Change

The Department of Environment and Climate Change (DECC), under the Ministry of Climate Change Adaptation, Meteorology & Geo-Hazards, Environment, Energy, and Disaster Management, plays a vital role in guiding Vanuatu towards a clean, resilient, and sustainable environment. Established in 1986 as the Vanuatu Environment Unit, it gained formal recognition in 2002 with the passage of the Environmental Protection and Conservation Act [CAP 283], which defines its responsibilities and objectives. The DECC's key functions include assessing environmental impacts of proposed developments, working with communities to establish Community Conservation Areas, collaborating with researchers to enhance knowledge of Vanuatu's ecosystems, protecting endangered species, regulating ozone-depleting substances, and managing waste and pollution alongside municipal and provincial governments.

The department's vision is "Leading Vanuatu to a clean, resilient, and sustainable environment," and its mission is reflected in its motto, "Think Environment First: Show People!" By leading through example, the DECC promotes sustainable practices and environmental awareness across the country. The DECC operates under two sets of guiding principles. The first focuses on promoting clean development, building climate-resilient communities, encouraging sustainable resource management and conservation, fostering a green economy, and exploring carbon schemes for Vanuatu. The second set of principles governs the internal operations of the department, emphasizing transparency, accountability, teamwork, professionalism, flexibility, community focus, and leadership.

In Vanuatu, the primary responsibility for adaptation data collection, planning, implementation, monitoring, evaluation, and reporting falls under the Department of Climate Change within the government. This department often collaborates with the National Disaster Management Department and engages with various sectors and communities to ensure ownership and participation in adaptation actions. This coordination is guided by the National Advisory Committee on Climate Change (NACCC). However, a systematic Monitoring and Evaluation (M&E) framework for climate resilience has not yet been fully developed. Efforts are underway to establish a robust M&E system, with the Department of Strategic Policy Planning and Aid Coordination taking the lead. Training on climate change and disaster monitoring and evaluation is being provided to relevant officers to build capacity, with the results of M&E activities being crucial for improving future planning and implementation of climate adaptation strategies.

Through these efforts, the DECC aims to ensure Vanuatu's natural heritage is preserved for future generations, while fostering economic growth and community resilience in the face of climate change.

Framework for Adaptation Programs (NAPA)

The Framework for Adaptation Programs in Vanuatu is anchored by the establishment of the National Advisory Committee on Climate Change (NACCC), formed in 1989 and comprising representatives from various government agencies, civil society, and stakeholders. The NACCC's mandate includes providing operational directives, making informed decisions on climate change issues, and coordinating climate change initiatives. The NAPA (National Adaptation Programme of Action) Process involves stakeholder consultations conducted at provincial levels to gather information on vulnerabilities and adaptation needs, followed by the evaluation and prioritization of adaptation strategies based on national perspectives and stakeholder input. The selection of adaptation options employs criteria-based selection using country-specific ranking criteria to ensure they address the most urgent climate change issues while integrating seamlessly with national plans, such as the 'Priorities and Action Agenda' and relevant sectoral plans. Finally, the framework emphasizes implementation and monitoring through pilot projects that test and demonstrate adaptation strategies, alongside capacity-building efforts aimed at enhancing the ability of institutions and communities to plan and respond effectively to climate change impacts.

International Environmental Agreements

Vanuatu actively participates in international and regional efforts to protect the environment by being a party to several important Multilateral Environmental Agreements (MEAs). These agreements address a wide range of environmental concerns, from biodiversity conservation to climate change mitigation. Key agreements that Vanuatu is a signatory to include the Convention on Biological Diversity (CBD), the Nagoya Protocol, and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), among others. At the regional level, Vanuatu is committed to the objectives of the South Pacific Regional Environment Programme (SPREP), which focuses on sustainable development and environmental protection in the Pacific. Between 2005 and 2014, Vanuatu ratified several significant international agreements, including the Stockholm Convention on Persistent Organic Pollutants, the Vienna Convention for the Protection of the Ozone Layer, and the Waigani Convention. These commitments reflect Vanuatu's dedication to addressing global environmental challenges and promoting sustainable management of its natural resources.

These international and regional commitments reflect Vanuatu's dedication to safeguarding its natural resources, ecosystems, and biodiversity for present and future generations. Through these MEAs, Vanuatu continues to play an active role in addressing global and regional environmental challenges.

Table 1.1: Multilateral Environmental Agreements

Category	Agreement	Status
Biodiversity	Convention on Biological Diversity (CBD)	R

	- Cartagena Protocol on Biosafety	-
	- Protocol on Access and Benefit-Sharing	A
	Convention on International Trade in Endangered Species (CITES)	R
	Convention on Migratory Species (CMS)	-
	Convention on Wetlands (RAMSAR)	-
	World Heritage Convention (WHC)	R
Waste and Pollution	Basel Convention	-
	Rotterdam Convention	-
	Stockholm Convention	R
Atmospheric Pollution	Vienna Convention	R
	- Montreal Protocol	R
Ship-Based Pollution	UNCLOS (Part XII: Protection and Preservation of the Marine Environment)	R
	London Convention (Prevention of Marine Pollution by Dumping of Wastes)	A
	- London Protocol	A
Climate Change	UNFCCC	R
	- Kyoto Protocol	A
	- Paris Agreement	R
Land Degradation	UNCCD	R
Regional Agreements	Waigani Convention	R
	Noumea Convention	-
	- Dumping Protocol	-
	- Emergencies Protocol	-

Ratification (R), Acceptance (Ac), Accession (A), Signed (S)

Source: Republic of Vanuatu: Review of Natural Resource and Environment Legislation. SPREP and EDO NSW, January 2018.

Table 2: Environmental Laws in Vanuatu

Law	Responsible Agency
Environmental Protection and Conservation Act [CAP 283]	DEPC

Environmental Impact Assessment Regulations	DEPC
Wild Bird (Protection) Act [CAP 30]	DARD
Prevention of Cruelty to Animals Act [CAP 78]	DARD
International Trade (Flora and Fauna) Act [CAP 210] and International Trade (Flora and Fauna) Regulations	DEPC
Animal Importation and Quarantine Act [CAP 201] and Regulations	BV
Animal Disease (Control) Act [CAP 220]	DARD
Fisheries Act No. 10 of 2014 and Regulations	VFD
National Parks Act [CAP 224]	DEPC
Forestry Act [CAP 276] and Regulations	DoF
Forestry Rights Registration and Timber Harvest Guarantee Act [CAP 265]	DoF
Plant Protection Act [CAP 239] and Regulations	BV
Quarantine Act [CAP 1]	MoH
Waste Management Act No. 24 of 2014	DEPC
Pollution (Control) Act No. 10 of 2013	DEPC
Control of Nocturnal Noise [CAP 40]	Port Vila Municipal Council, Luganville Municipal Council
Public Health Act [CAP 234]	MoH
Shipping Act [CAP 53]	DoPM
Ports Act [CAP 26]	DoPM
Prevention of Collisions at Sea Act [CAP 166]	DoPM
Derelict Vessels (Disposal) Act [CAP 9]	DoPM
Maritime Act [CAP 131]	MIPU (as Ministry responsible for transport)

Maritime Zones Act No. 6 of 2010	DoPM
Pesticides (Control) Act [CAP 226]	DARD
Customs Act No. 7 of 2013	Customs
Quarry Act No. 9 of 2013	DEPC
Geothermal Energy Act [CAP 197]	DoE
Ozone Layer Protection Act No. 27 of 2010 and Ozone Layer Protection (Fees and Penalty Notices) Regulations	DEPC
Petroleum (Exploration and Production) Act [CAP 227]	DGMWR
Mines and Minerals Act [CAP 190]	DGMWR
Land Reform Act [CAP 123]	DGMWR
Physical Planning Act [CAP 193]	MoL
Foreshore Development Act [CAP 90]	DLA and provincial and municipal councils
Public Roads Act No. 35 of 2013	MIPU
Water Resources Management Act [CAP 281]	DGMWR
Water Supply Act [CAP 24]	DGMWR
Water Supply Apparatus Act [CAP 87]	DGMWR
Meteorology Act No. 4 of 1989 [Cap 204]	VMGD
National Disaster Act [CAP 267]	NDMO
Vanuatu National Cultural Council Act [CAP 186]	Ministry of Justice and Social Welfare (MoJSW)
Preservation of Sites and Artifacts Act [CAP 39] and Order	MoJSW

Source: Vanuatu National Environment Policy and Implementation Plan 2016–2030.

Legislation

National Constitution of Vanuatu

The Constitution of the Republic of Vanuatu, enacted on July 30, 1980, establishes the foundation of the country's legal system, blending English common law, French civil law, and indigenous customary law. It outlines the structure of Parliament, whose members elect the Prime Minister and form the executive branch with the Council of Ministers. The President, elected by an electoral college, serves in a ceremonial role but holds the power to pardon or commute sentences. The Malvatumauri Council of Chiefs, also established by the Constitution, comprises elected chiefs who advise on matters of custom and tradition, preserving ni-Vanuatu culture.

The Constitution emphasizes environmental protection, placing a duty on all Ni-Vanuatu to safeguard the nation's resources for future generations. The 2013 amendments introduced Article 78, which recognizes customary institutions for resolving land disputes, with decisions that are binding in law and not subject to appeal.

Environmental Protection and Conservation Act

The Environmental Protection and Conservation Act 2002, along with its amendments, forms the legislative framework for implementing Vanuatu's environmental provisions. Covering multiple sections, the Act focuses on the management, conservation, protection, and enhancement of Vanuatu's natural environment. It addresses crucial aspects such as pollution prevention and control, the assessment of environmental impacts from economic development, and the sustainable use of natural resources.

The Department of Environmental Protection and Conservation (DEPC), established under this Act, is tasked with enforcing effective environmental management practices across various sectors, including waste, biodiversity, and pollution control. The DEPC ensures that developmental projects with potential adverse environmental effects undergo Environmental Impact Assessments (EIA) before implementation, safeguarding Vanuatu's ecosystems.

The Act also facilitates the establishment of Community Conservation Areas and the protection of biodiversity. In its efforts to regulate and monitor environmental impacts, the DEPC plays a vital role in maintaining environmental sustainability, reducing pollution, and supporting climate change mitigation in Vanuatu.

Protected Areas

The National Parks Act 1993 provides for the declaration and protection of National Parks and nature reserves in Vanuatu, safeguarding areas with unique ecosystems, threatened species, and sites of environmental or scientific significance. It promotes conservation, scientific study, and public enjoyment. The Act establishes a National Parks Board to identify and manage these areas, with local management committees appointed by the Minister. The Minister can also make regulations, and violations of the Act are considered offences. Vanuatu currently has several protected areas, including Marine Protected Areas, Forest Conservation Areas, and Reserves, highlighting the country's dedication to environmental preservation.

Impacts, Risk and Vulnerabilities

Observed Climate Changes

Vanuatu is experiencing noticeable changes in its climate and weather patterns, which are already significantly affecting the country's environment, economy, and society. Both ocean and air temperatures are rising, and while there has been little long-term change in average rainfall, fewer but stronger tropical cyclones (TCs) have been observed, along with a rise in sea surface height (SSH).

Temperature and Rainfall

The Vanuatu region has warmed by approximately 0.7°C since the pre-industrial period (1850–1900) upto 2023. However, there is no clear long-term trend in total rainfall for the country over the period from 1993 to 2020. Recent years have shown an increase in extreme daily and sub-daily rainfall, which is expected due to a warmer atmosphere holding more moisture. The intensity of storms may also contribute to these trends in short-duration rainfall. Additionally, droughts are becoming more impactful as higher temperatures enhance evapotranspiration, drying the surface of soil and plants.

Extreme Rainfall and Tropical Cyclones

The total number of tropical cyclones (TCs) passing within 500 km of Vanuatu has decreased from around 36 per decade to approximately 26 per decade between the periods 1971–1995 and 1996–2021. Although this 28% decrease is not statistically significant, the proportion of severe TCs has risen from 45% to 57%. The mean severity, as indicated by the sustained wind speed of TCs passing within 500 km and 250 km of Vanuatu, has increased by around 15% in recent decades. Severe events such as TC Pam (2015), TC Keni (2018), and TC Harold (2020) exemplify this increase in intensity. TCs are more likely to affect Vanuatu during La Niña years than during El Niño or neutral years.

Sea Surface Temperature

There is a clear warming trend in sea surface temperatures (SST) observed in the tropical Pacific, including around Vanuatu. Historically, cool seasons were significantly cooler than they are now, with SSTs in the region occasionally dropping below 25°C—this occurred five times during the 1980s and 1990s. However, since the 1997 El Niño event, SSTs have consistently remained above this threshold. This warming trend has led to an increase in the frequency and duration of marine heatwaves. In the 1980s to 2000s, the average annual duration of marine heatwaves ranged from 5 to 16 days, but during the 2010s, this increased to 8 to 20 or more days. The rising SST poses serious challenges for temperature-sensitive marine ecosystems, including coral reefs, seagrass beds, and fish habitats.

Sea Level Rise

One of the most pressing concerns for Vanuatu is rising sea levels caused by greenhouse gas emissions and the resulting warming effect. In the western Pacific, including around Vanuatu, sea levels have risen faster than in other parts of the tropical Pacific. Between 1993 and 2020, sea levels around Vanuatu rose by about 10–15 cm, which has severe consequences for low-

lying coastal areas prone to flooding and erosion. However, vertical land motion from earthquakes has offset some of the effects of sea level rise in certain locations, such as Port Vila. Despite this, Vanuatu remains highly vulnerable to the long-term impacts of sea level rise.

Projected Climate Changes

Increasing concentrations of greenhouse gases and other human influences on the climate will continue to drive significant changes in Vanuatu's climate. Many of the changes already being observed are expected to intensify, and their magnitude will depend on the extent of global warming. Likely changes include more frequent and intense extreme events such as marine heatwaves, heavy rainfall, droughts, and flooding due to sea level rise. Tropical cyclone (TC) frequency is projected to decrease, but the proportion of severe TCs is expected to increase.

Warming Ocean and Changing Atmosphere

The future temperature changes for Vanuatu are primarily influenced by the level of global greenhouse gas emissions and the corresponding amount of global warming. A study using CMIP6 climate models assessed future changes in sea surface temperatures (SST), rainfall, and sea level rise (SSH) in the tropical Pacific, including Vanuatu. (Dhange & Widlansky, 2022) Projections indicate that warming in the region will be slightly less than the global average, especially over the surrounding ocean. For instance, under a 3.0 °C increase in Global Mean Surface Temperature (GMST), Vanuatu is expected to experience about 2.3 °C of warming, with land temperatures rising similarly to the global average. If global warming is limited to 1.5 °C, the region will warm by approximately 1.2 °C.

Although the warming is expected to be lower than in some other regions, the impacts on Vanuatu will be significant due to its high vulnerability to climate risks. These changes are likely to affect local ecosystems, agriculture, fisheries, and coastal communities. Rising SSTs will exacerbate coral bleaching and threaten marine biodiversity, which supports fisheries and coastal livelihoods. Changes in rainfall patterns are expected to bring more extreme weather events, including longer dry spells and more intense rainfall, increasing the risk of droughts and flooding. Sea level rise will pose a significant threat to coastal areas, leading to flooding, erosion, and saltwater intrusion, which could undermine agricultural productivity and displace vulnerable communities. These climate changes will continue to challenge the resilience of Vanuatu's island communities, impacting their livelihoods and the long-term sustainability of their environment. As a result, adaptation strategies and resilience-building efforts will be crucial in mitigating the growing impacts of climate change on the country's economy and society.

Changing Rainfall, Droughts, and Storminess (Including TCs)

Future warming is projected to make the tropical Pacific climate generally wetter and occasionally stormier, as warmer air holds more moisture (Held & Soden, 2006; Seager, Naik & Vecchi, 2010). However, Vanuatu's specific region could become either wetter or drier. Storminess here refers to a range of events, from heavy downpours to intense tropical cyclones (TCs). In the equatorial Pacific, expected to warm the most this century (Xie et al., 2010; Ma, Xie & Kosaka, 2012), rainfall projections indicate a significant increase, especially in the central and eastern areas where all CMIP6 models agree on a wetter future (Dhage &

Widlansky, 2022). In contrast, uncertainty surrounds rainfall projections for the western tropical Pacific, including Vanuatu, due to conflicting climate model responses to greenhouse warming (Brown et al., 2020; Brown, Moise & Delange, 2012; Widlansky et al., 2013).

The “wet gets wetter” effect suggests increased rainfall for Vanuatu, but an opposing effect, linked to atmospheric subsidence in non-equatorial areas, may lead to drying. Whether Vanuatu will become wetter or drier depends on shifts in the South Pacific Convergence Zone (SPCZ): a northern shift would bring drier conditions, while a southern shift would result in a wetter climate (Narsey et al., 2023). This variability results in rainfall projections for Vanuatu by 2050 ranging from -6% to +9% under low emissions and -12% to +14% under high emissions, requiring planners to account for both possibilities (CSIRO & SPREP, 2021).

Storms and TCs will remain a concern regardless of rainfall changes, as they bring high winds, heavy rains, and storm surges. While the frequency of TCs may decrease due to increased atmospheric stability from greenhouse warming, the intensity of the strongest TCs is expected to rise as warmer oceans fuel them (Emanuel, 1999; Sobel et al., 2016). Extreme rainfall is projected to intensify, with models for Port Vila showing increases of 21% by mid-century under moderate emissions (RCP4.5) and up to 70% by century’s end under high emissions (RCP8.5). This aligns with warmer atmospheres supporting more moisture, a critical factor for intense storms.

Droughts will also persist, particularly during El Niño events, with potential frequency increases under high emissions. Although annual rainfall may not change significantly future droughts may be driven by increased temperatures and climate variability, with more extreme El Niño-related dry spells possible (Kirono et al., 2023).

Sea Level Rise

Sea level rise is a major threat to Vanuatu and other Pacific island nations. As global sea levels rise due to climate change, Vanuatu will face more frequent and intense coastal flooding and erosion. The specific impacts will vary depending on factors such as local vertical land motion, the presence of sandy beaches, rocky cliffs, coral reefs, and natural climate variability, including El Niño–Southern Oscillation (ENSO) events.Greenhouse warming is expected to enhance sea level extremes associated with El Niño events in the southwestern tropical Pacific. Low sea level events are projected to double in occurrence, while high sea level events during La Niña are expected to become more extreme, leading to increased frequency of high-tide flooding.

The rate of global sea level rise will be a key factor for Vanuatu's relative sea level changes. Depending on emissions scenarios, projected sea level rise by 2050 ranges from 17–30 cm under a low emissions pathway to 22–37 cm under a high emissions pathway. By 2100, the projections increase to 33–64 cm for a low emissions pathway and 68–122 cm for a high emissions pathway. There is also a low likelihood but high impact scenario where rapid disintegration of Antarctic ice shelves could lead to much higher sea level rise.

Even though uplifting land motions may mitigate sea level rise in some areas temporarily, they are unlikely to offset future sea level rise completely. As a result, Vanuatu will face significant challenges related to coastal infrastructure, economic sustainability, and societal impacts,

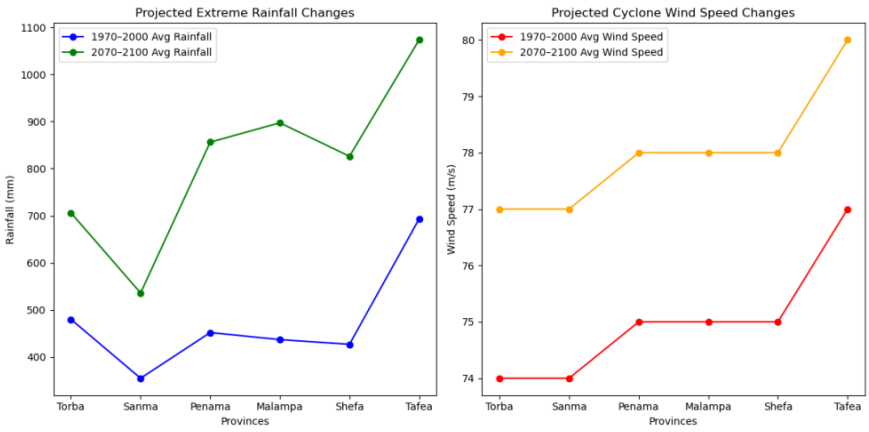
requiring adaptation and mitigation strategies such as coastal protection, water management, and disaster risk reduction.

Extreme Rainfall

The graphs illustrate the projected changes in extreme rainfall intensity and cyclone wind speed intensity across the provinces of Vanuatu for the periods 1970–2000 and 2070–2100 under a high greenhouse gas emissions pathway (RCP8.5). In (Figure 2) the first graph, which depicts rainfall intensity, all provinces show significant increases in rainfall, with some regions experiencing nearly double the average rainfall by the end of the century. Notably, provinces like Malampa and Shefa are projected to see increases in rainfall intensity of 95% to 97%, indicating a substantial rise in the frequency and severity of extreme rainfall events. However, the uncertainty ranges are also notable, especially in provinces like Penama and Malampa, where the variability in future projections is quite large.

In the second graph, representing changes in cyclone wind speed intensity, all provinces show a moderate increase of about 5% in average wind speeds by 2070–2100.

Figure 2: projected changes in Projected Extreme Rainfall Changes and cyclone wind speed intensity (categories 1–5, 100-year recurrence interval) between the current climate (1970–2000) and the future climate (2070–2100) across each province of Vanuatu for a high emissions pathway (RCP8.5).



The projections suggest that the increase in wind speeds during extreme events may not be as dramatic as the increase in rainfall, but the heightened intensity of cyclone wind speeds could still lead to greater damage during severe storms. The consistent pattern across all provinces suggests a uniform rise in cyclone intensity, with minimal variation in uncertainty. Together, these projections underscore the increasing risks posed by climate change to Vanuatu, highlighting the need for strengthened adaptation and disaster risk reduction strategies.

Ocean Acidification

Projected ocean acidification (OA) in Vanuatu indicates significant declines in both pH and aragonite saturation under various emissions scenarios, with the largest impacts seen in high-emission pathways. Under RCP8.5, by 2050, a pH drop of 0.4 units represents a 150% increase in ocean acidity, which will severely hinder the ability of corals and other marine organisms to form skeletons and shells, threatening the survival of coral reefs. This scenario suggests that coral reefs in Vanuatu may not only stop growing but begin dissolving. However, under a low-emission scenario (RCP2.6), the pH drop is much smaller (0.05 units), and aragonite saturation may start to recover after 2060, offering some hope for coral survival. There is high confidence that the rate of OA is proportional to CO_2 emissions, and medium confidence that coral viability will be compromised under high-emission pathways, leading to harmful effects on marine ecosystems in the region.

Marine heatwaves

Projected marine heatwaves (MHWs) in Vanuatu show significant increases in both frequency and intensity under various emissions scenarios. Historical data (cantered on 2005) indicate an average of about 25 MHW days per year. Under a low-emission scenario (SSP126), this increases to 80–150 days by 2050, and under a high-emission scenario (SSP585), the number of MHW days reaches 170–310, with many falling into the 'Strong' and 'Severe' categories. By

2090, under low emissions, the number of MHW days rises to 110–190, with more 'Strong' events. Under high emissions, MHW days increase drastically to 320–360, with significant rises in 'Severe' and 'Extreme' events. Northern Vanuatu is projected to experience even greater increases, highlighting the escalating risk to marine ecosystems under high emissions.

Vanuatu's Vulnerability to Climate Change

Vanuatu, located in the South Pacific Ocean and consisting of approximately 80 islands, is renowned for its stunning landscapes, rich culture, and diverse tourist attractions. However, its position on the Pacific Ring of Fire makes it highly vulnerable to natural hazards such as tropical cyclones, intense rainfall, earthquakes, volcanic eruptions, and tsunamis. Climate change has intensified the impact of these hazards, increasing risks like rising sea levels, more frequent marine heatwaves, extreme rainfall events, and higher temperatures. Tropical cyclones, in particular, have caused significant damage to Vanuatu's infrastructure and livelihoods in recent years.

Recognizing the increasing threat posed by these natural hazards and the broader impacts of climate change, the Vanuatuan government has made resilient and sustainable development a national priority. Efforts have been directed towards conducting climate risk and vulnerability assessments, which are vital for understanding how climate risks will evolve over time. These assessments are instrumental in enabling the government to make informed decisions to improve the country’s resilience and protect its communities from future climate-related disasters.

Recent Climate Risk and Resilience Work in Vanuatu

The Vanuatu Climate Futures Portal, developed under the Van-KIRAP initiative by CSIRO, VMGD, and SPREP, provides a comprehensive climate data visualization tool to support resilience planning across sectors such as agriculture, infrastructure, fisheries, tourism, and water. This portal offers climate hazard projections, impact assessment guidance, and resources like case studies to inform decision-making.

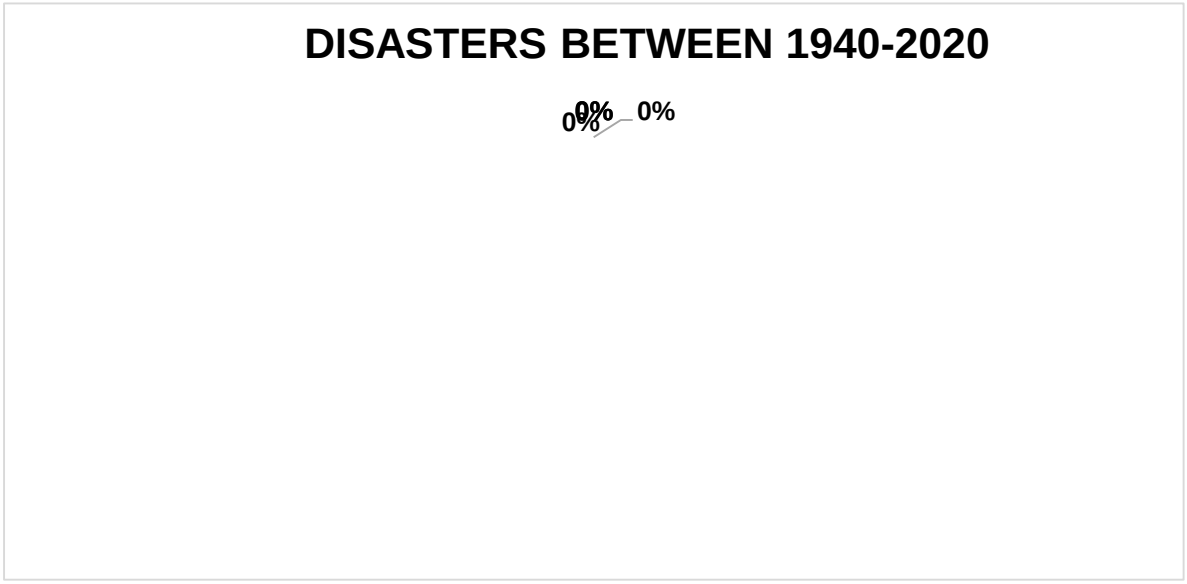
Key initiatives supporting this work include the Vanuatu National Adaptation Plan of Action (2019-2030) and SPREP-led projects like the Climate Change and Disaster Risk Reduction Assessment for Greater Port Vila. Tools such as the ClimateWatch mobile app and the Traditional Knowledge Indicators booklet further enhance community-based climate forecasting.

The Vanuatu Rapid Climate Risk Assessment Framework (RCRAF) addresses the need for simplified, on-the-ground risk assessments. Aligned with the Van-KIRAP portal and based on New Zealand’s MfE guidance, RCRAF provides a user-friendly, rapid assessment method for non-experts, focusing on the natural environment, built environment, and people/operations to identify risks and prioritize adaptation strategies. This integrated approach strengthens Vanuatu's resilience to climate change.

Exposure to Climate Hazards

Vanuatu is highly exposed to various natural hazards, including cyclones, volcanic eruptions, earthquakes, tsunamis, urban and coastal flooding, and landslides. It is ranked as the highest country at risk from natural hazards and climate change globally. According to EM-DAT, Vanuatu experienced nearly 50 devastating disasters between 1940 and 2020, with storm events alone accounting for 59% of these disasters, affecting over 600,000 people. (Figure 3) Future projections estimate that Vanuatu could incur average annual losses of approximately USD 48 million due to earthquakes and tropical cyclones (TCs). There is a 50% chance of experiencing disaster-related losses exceeding USD 330 million within the next four decades, and a 10% chance of losses surpassing USD 51.8 billion (Day et al., 2019)(GFDRR, 2019)(The World Bank, 2015)(EM-DAT, 2020).

Figure 3 Number of disasters in Vanuatu between 1940 and 2020 (EM-DAT, 2021)



Vanuatu typically faces 2-3 cyclones each season, primarily between November and April. TCs result in heavy rainfall, flash flooding, coastal and riverine flooding, storm surges, strong winds, and landslides. Between 1969 and 2010, Vanuatu experienced a total of 101 TCs in its Exclusive Economic Zone, with an average annual occurrence of around 20 storms between 1980 and 2020. Tropical Cyclone Pam remains the most economically devastating storm in Vanuatu's history, with losses estimated at over USD 450 million, affecting nearly 70% of the population. Similarly, Tropical Cyclone Harold in April 2020 impacted 16,000 people and caused significant damage to infrastructure and agriculture(Pacific Climate Change Portal, 2020)(GFDRR, 2011)(The World Bank, 2015).

Future projections indicate a potential decrease in the number of TCs by the end of the century; however, the cyclones that do occur are expected to have greater average maximum speeds (by 2%-11%) and an increase in rainfall intensity (by 20%) in areas within 100 km of the cyclone(PACCSAPP, 2013)(The World Bank, 2021)(Australian Bureau of Meteorology and CSIRO, 2011).

Volcanic activity also poses a significant risk; the ongoing eruption of Manaro Voui on Ambae Island since late 2017 has led to the mass evacuation of over 10,000 residents. Furthermore, landslide risk is heightened due to rainfall patterns and the geography of the islands.

Rainfall projections indicate potential decreases in dry season rainfall and increases in wet season rainfall, alongside a rise in days of extreme rainfall. Sea level rise remains a critical concern, with a recorded increase of 6 mm per year since 1993. By 2030, under a high emissions scenario, sea levels could rise between 3-17 cm, continuing to rise to 21-34 cm by 2060 and 40-96 cm by the century's end, which will exacerbate risks of storm surges and coastal flooding(Australian Bureau of Meteorology and CSIRO, 2011)(The World Bank, 2021)(NASA, 2022). Additionally, public health risks are heightened due to population displacement from various hazards, leading to overcrowding in resettlement areas and increasing the transmission risk of communicable diseases such as acute respiratory infection and measles(IFRC, 2017)(MOH, 2022)(IDCM, 2018).

Table 3: Climate hazard definitions and Vanuatu examples

Climate Hazard	Description	Vanuatu Example
Severe Droughts	Droughts are expected to increase in both duration and intensity.	Severe droughts were last experienced in 2015 and 2020 in the Southern Islands.
Extreme Rainfall	Caused by tropical cyclones, interannual rainfall variability, and ENSO. The total rainfall can be used as an indicator of extreme rainfall.	Vanuatu experiences extreme rainfall from tropical cyclones and the location of the Southern Pacific and Inter-Tropical Convergence Zones. The La Niña phase results in wetter conditions.
Tropical Cyclones	Rotating storms developing over warm tropical oceans, defined by a 10-minute sustained wind speed of ≥17.5 m/s. They cause strong winds, heavy rainfall, and storm surges.	Frequency of cyclones is expected to decrease, but intensity will increase. El Niño results in fewer cyclones, while La Niña brings more cyclones.
Ocean Acidification	Caused by increased atmospheric CO2 concentrations and marine heat stress. The reduction in ocean pH affects marine organisms' ability to build and maintain calcium carbonate structures like corals and shells.	Ocean acidification hinders the development of coral reefs and marine organisms, affecting Vanuatu's marine biodiversity and impacting the fisheries and tourism sectors.
Marine Heatwaves	Prolonged periods (5+ days) of anomalously warm sea surface temperatures caused by ocean currents, atmospheric heat flux, and climate variability drivers like ENSO.	Marine heatwaves, more frequent and intense in northern Vanuatu, can cause coral bleaching, harming the tourism and fisheries sectors.
Extreme Temperature	Temperature variations throughout Vanuatu, with the hottest days occurring during the wet season and the coolest days during the dry season. Northern Vanuatu tends to be hotter and wetter than the south. Coastal regions may experience milder temperatures due to ocean influences.	Higher temperatures are seen during the wet season, with the cooling effects of the ocean and sea breezes impacting coastal areas. Tropical cyclones can also affect local temperatures.

Observed and Potential Impacts of Climate Change, Vulnerabilities

Climate Change Impacts

Vanuatu is highly vulnerable to climate change impacts, ranking 140th out of 187 countries in the 2024 ND-GAIN Index. This index evaluates countries based on their vulnerability to climate change and other global challenges, as well as their readiness to enhance resilience. A lower score indicates greater vulnerability, while a higher score reflects better preparedness to strengthen resilience. Vanuatu's ranking highlights its significant exposure to climate risks and the need for improved adaptive capacity.

Observed Impacts

Water

Pacific Island nations, including Vanuatu, face significant challenges in maintaining access to clean water. Water sources vary by island type, with volcanic islands having small rivers and streams, while low-lying islands lack these resources. Many Pacific islands rely heavily on rainfall, making them vulnerable to variability in precipitation. Groundwater, though available in some regions, is increasingly at risk of salinization, especially on smaller islands.

Access to basic water services is uneven. In 2018, 90.5% of Vanuatu’s population had access to at least basic water supplies. Urban households primarily rely on piped water, while rural areas depend heavily on rainwater collected in tanks. However, studies show significant E. coli contamination in rural rainwater tanks, posing health risks. Droughts and increasing groundwater salinization are expected to worsen these challenges, necessitating improved water storage infrastructure. Urban aquifers, such as those in Port Vila and Luganville, are already under pressure due to population growth.

Coastal Zones

Sea-level rise poses severe threats to the coastal zones of Pacific Island nations. The global mean sea level is projected to rise between 0.44 to 0.74 meters by the end of the 21st century, with localized variations influenced by climate phenomena like ENSO. The western Pacific has experienced above-average rates of sea-level rise. In Vanuatu, rates were measured at 6 mm/year between 1990 and 2010, with tectonic movements exacerbating land subsidence and accelerating net sea-level encroachment. Rising sea levels increase the frequency and intensity of extreme sea-level events, such as storm surges and wave-driven flooding. Healthy coral reefs, which can mitigate these impacts, are under threat from degradation, emphasizing the need for conservation. Coastal infrastructure and ecosystems face long-term risks of permanent inundation.

Coral Reefs and Fisheries

Ocean acidification and increased temperatures are reducing calcium carbonate saturation, essential for the formation of coral reefs and marine organisms' skeletons. Projections under emission scenarios RCP4.5 and RCP8.5 indicate that conditions may become unsuitable for sustaining healthy coral reefs in Vanuatu. This degradation, coupled with overfishing, poses a dual threat to marine biodiversity and fisheries. Climate change impacts, such as shifts in species distribution and reduced dissolved oxygen levels, are projected to decrease the

maximum catch potential of marine species. For Vanuatu, shifts in tuna stocks eastward are expected, necessitating adaptations in fishing practices and increased reliance on international waters. While Vanuatu may remain a net fish exporter until 2050, adaptation measures will require significant investment.

Island Ecology

Sea-level rise and climate change threaten the biodiversity and ecosystem functions of Pacific islands. Species on low-lying islands face habitat loss, and limited space for migration increases extinction risks. For instance, endemic lizards and migratory seabirds may lose critical habitats. Research indicates substantial biodiversity losses in Pacific islands, with the range sizes of most tree species in New Caledonia projected to decline by over 50% due to climate change. These findings highlight the urgent need for conservation efforts to protect island ecosystems and their unique biodiversity.

Agriculture and Food Security

Agriculture is a cornerstone of Vanuatu's economy, especially in rural areas. Food products constituted 85% of exports in 2011, yet the country relies on imports to meet food security needs, reflecting a food trade deficit equivalent to over $50 per capita in 2011. Key crops include coconuts, kava, and cocoa, with coconuts being highly versatile—used for food, drink, construction, and exports (e.g., copra made up 35% of exports in 2007). Approximately one-third of cultivable land is farmed, predominantly for coconuts.

Climate change poses significant risks to food production. Direct impacts include changes in carbon dioxide levels, precipitation, and temperatures, while indirect effects arise from altered water availability, soil quality, erosion, pests, and invasive species. Coastal farming areas face threats like saltwater intrusion, which reduces crop efficiency and leads to failures. Cyclones, though their future intensity remains uncertain, also cause severe damage. The global decline in crop yields—5% for wheat and 6% for maize under 1.5°C warming scenarios—underscores the risks to agriculture. Labor-intensive farming in Vanuatu is also vulnerable to climate-induced productivity declines. Higher temperatures have already reduced global labor productivity by 10% and may lead to a 20% reduction by the 2050s under high-emission scenarios. Combined, these challenges are likely to disrupt food production, consumption, and trade.

Tourism

Tourism contributes over 40% of Vanuatu's GDP, making it highly susceptible to climate change. Rising sea levels, coastal erosion, and environmental degradation threaten beaches and dive sites, reducing the sector's appeal. Recreational diving, a significant attraction, faces risks from reef loss and coastal damage. Agroecological tourism offers potential synergies by supporting traditional practices while promoting sustainability. Global mitigation efforts could also indirectly affect Vanuatu's tourism. For instance, increased travel costs due to carbon reduction policies may deter long-haul visitors. Studies emphasize the need for proactive government policies to adapt the tourism sector to climate risks and enhance coordination and benefit-sharing among stakeholders.

Poverty, Inequality, and Vulnerability to Climate-Related Disasters

Pacific nations, including Vanuatu, face the compounded risk of multiple, simultaneous climate hazards driven by intensifying climate change. This situation is exacerbated by substantial uncertainties in climate modeling, necessitating efforts to mitigate vulnerability and address the root causes of risk. For instance, Vanuatu has made strides in disaster risk management, evidenced by effective early warning systems during Cyclone Pam in 2015. However, limited financial resources for disaster response remain a challenge, with Vanuatu's annual disaster management budget of $265,000 and disaster insurance facility of $17 million often insufficient to meet demand.

Communities, particularly the poorest, bear the brunt of these vulnerabilities. Challenges include limited access to climate-resilient infrastructure, such as water storage and irrigation, reliance on food imports, and exposure to food insecurity. Additionally, heavy manual labor jobs—typically among the lowest-paying—are most affected by heat stress, exacerbating inequality. Climate-driven migration poses further risks, with poorer households and communities being disproportionately vulnerable to displacement.

Gender Dimensions

Climate-related disasters amplify existing socio-economic and cultural inequalities. Women and children are at heightened risk due to disparities in access to resources, decision-making power, and exposure to gender-based vulnerabilities. Factors such as limited access to credit, constrained opportunities, and socio-cultural norms contribute to these disparities. The absence of sex-disaggregated data further hampers targeted policy interventions.

Human Health

The health impacts of climate change in Vanuatu include heat-related illnesses, malnutrition, waterborne diseases, and vector-borne illnesses. Rising temperatures and intensified heatwaves are projected to significantly increase heat-related mortality. For example, heat-related deaths in the Australasian region could increase by 211% by 2030 under medium emissions scenarios. Water salinization due to sea-level rise poses additional health risks, such as increased hypertension and complications during pregnancy. Temperature changes also correlate with higher incidences of diarrheal diseases. Warmer conditions may promote the proliferation of pathogens in marine and food environments, further threatening public health in Pacific Island nations.

Table 4: Potential impacts of climate hazards on elements of industry

Element	Coastal Inundation	Extreme Rainfall	Tropical Cyclone	Drought	Marine Heatwaves	Ocean Acidification	Extreme Temperature
Natural							
Coastal/Marine Ecosystem	X	X	X	X	X	X	X

Terrestrial Ecosystem		X	X	X			X
Freshwater Ecosystem		X	X	X			X
Built							
Inhabited Buildings	X	X	X	X			X
Ports/Wharves	X	X	X	X		X	X
Airports	X	X	X	X			X
Telecommunications	X	X	X	X			X
Electricity	X	X	X	X			X
Wastewater Infrastructure	X	X	X	X			X
Transport Assets	X	X	X	X			X
Water Supply	X	X	X	X			X
Storm Water/Flood Management	X	X	X	X			X
Uninhabited Buildings	X	X	X	X			X
Evacuation Structures	X	X	X				X
Operations							
Outdoor Land Activities	X	X	X	X			X
Outdoor Marine Activities	X	X	X	X	X	X	X
Outdoor Freshwater Activities	X	X	X	X			X
Outdoor Coastal Activities	X	X	X	X	X	X	X

Land Transportation Activities	X	X	X	X			X
Water Transportation Activities	X	X	X	X	X	X	X
Office/Shop/Admin Activities	X	X	X	X			X
Goods Supply Activities	X	X	X	X	X	X	X
Construction Activities	X	X	X	X			X

Approaches, methodologies, and tools

Sources of Climate Information

The development of climate projections relies on an integrated understanding of the climate system derived from observed data, model simulations, and theoretical knowledge. Past and projected climate changes, impacts, and vulnerabilities are assessed using a combination of historical observations, global climate models (GCMs), high-resolution regional climate models, and synthetic data for specific climate phenomena like tropical cyclones. These datasets allow researchers to analyze trends, identify vulnerabilities, and predict future changes under different greenhouse gas and aerosol emission scenarios as described by the Representative Concentration Pathways (RCPs) used in the IPCC Fifth Assessment Report (IPCC, 2013).

Methodologies for Climate Projections

The methodologies for generating projections involve:

1. **Global Climate Models (GCMs):** Historical and future climate simulations are obtained from the Coupled Model Intercomparison Project Phase 5 (CMIP5), which provides multi-model data under various emission scenarios.
2. **High-Resolution Regional Models:** The Conformal Cubic Atmospheric Model (CCAM) is used to downscale GCM outputs, providing finer spatial and temporal detail. This includes temperature, rainfall, and extreme weather events.
3. **Synthetic Tropical Cyclone Data:** Synthetic tracks based on eight GCMs are used to assess tropical cyclone characteristics and behavior under changing climates.

The projection periods include a reference period centered on 1995 (1986-2005) and future periods centered on 2030, 2050, 2070, and 2090. For tropical cyclones, the future periods include 2041-2060 and 2081-2100.

Challenges and Uncertainties

Model Biases

Model biases and resolution constraints are inherent in these methodologies:

- **Temperature:** CCAM simulates seasonal temperature cycles well but exhibits biases, such as underestimating maximum temperatures (-2 to -3°C) and overestimating minimum temperatures (+3 to +4°C). These biases arise from limited resolution (50 km), which prevents accurate representation of smaller islands and their unique land-sea temperature dynamics.
- **Rainfall:** CCAM reproduces mean rainfall patterns with significant correlations to observed data but tends to underestimate mean daily rainfall by 24% to 32%. Wet season rainfall is overestimated, while dry season rainfall is underestimated.

Observational and Data Limitations

- Observational data, such as station data and gridded datasets (e.g., ERA5, GPCP, CMAP), show variability. CCAM's performance is influenced by its alignment with these data sources and parameterizations for convection, turbulence, and land cover.

Model Ensemble Uncertainty

The use of multi-model ensembles from GCMs (up to 28 simulations) and CCAM (5 simulations) helps quantify uncertainty. Results are presented as multi-model medians and percentile ranges to account for variability among models. For instance, projected rainfall changes may vary significantly across models, highlighting the range of possible outcomes.

Periodic Institutional Assessments

Climate projections and vulnerability assessments often emerge from institutionalized processes conducted periodically. These processes ensure that updated knowledge and tools inform planning and decision-making. For example, national climate risk assessments conducted every five years provide critical data for policy and adaptation strategies.

Rapid Climate Risk Assessment

The VanKIRAP Climate Futures Portal provides a rapid climate risk assessment tool designed by CSIRO and the Vanuatu Meteorology and Geo-Hazards Department (VMGD). This portal and its associated guidance aim to offer a straightforward approach to assess climate risks efficiently, making it accessible for users who need quick insights into potential climate impacts without extensive technical expertise.

The Risk Assessment step in the Vanuatu Rapid Climate Risk Assessment Framework (RCRAF) serves as a foundational action framework for identifying and prioritizing climate risks across various sectors. This systematic approach empowers stakeholders to make informed decisions regarding climate adaptation and resilience investments.

The scoring process is guided by the New Zealand Ministry for the Environment's 2021 document, "A Guide to Local Climate Change Risk Assessments." This document outlines a standardized approach to evaluating climate risks.

Table 5: Risk matrix (combining vulnerability and exposure)

	Exposure			
Vulnerblity	Low	Moderate	High	Extreme
Extreme	Moderate	High	Extreme	Extreme
High	Low	Moderate	High	Extreme
Moderate	Low	Moderate	Moderate	High
Low	Low	Low	Moderate	High

Source: Vanuatu Rapid Climate Risk Assessment Framework and Methodology

Table 6: Vulnerability Rating

Vulnerability Rating	Definition
Extreme	Extremely likely to be adversely affected; the element or asset is highly sensitive to a given hazard and has a low capacity to adapt.
High	Highly likely to be adversely affected; the element or asset is highly sensitive to a given hazard and has a low capacity to adapt.
Moderate	Moderately likely to be adversely affected; the element is moderately sensitive to a given hazard and has a low or moderate capacity to adapt.
Low	Low likelihood of being adversely affected; the element has low sensitivity to a given hazard and a high capacity to adapt.

Source: Vanuatu Rapid Climate Risk Assessment Framework and Methodology

Adaptation Priorities and Barriers

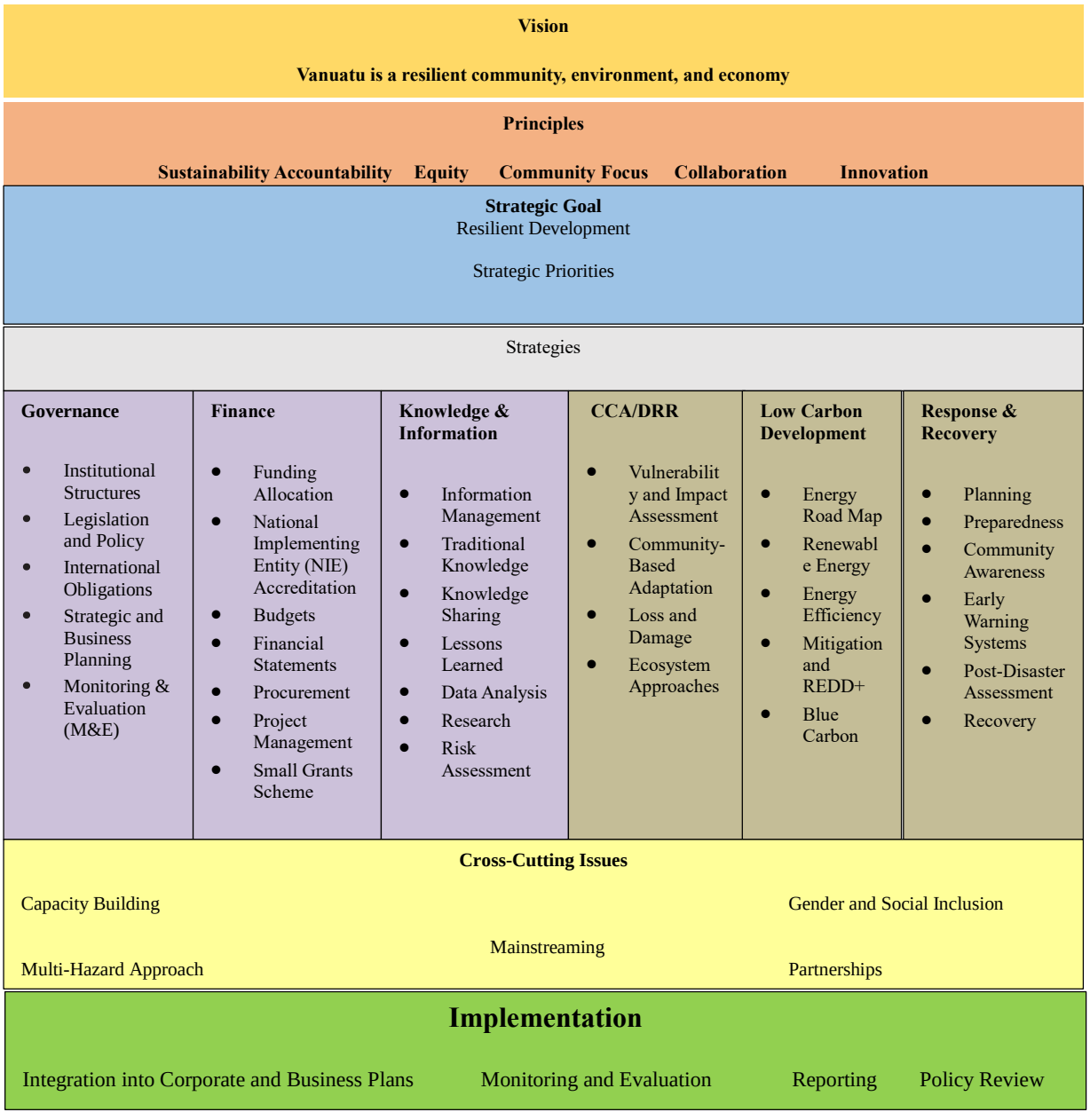
Domestic priorities and progress towards those priorities

Vanuatu's strategic goal for climate change and disaster risk reduction is resilient development, focusing on the ability to quickly recover from climate and disaster shocks.

Aligned with the National Sustainable Development Plan (2016–2030), this goal guides planning and decision-making across all sectors.

Six strategic priorities are grouped into two categories: systems (governance, finance, and knowledge) and themes (climate adaptation, low-carbon development, and disaster response). Each priority is supported by specific actions and strategies to enhance resilience, with clear roles for lead agencies and resources.

Figure 2: Diagram of the structure of the Vanuatu Climate change and disaster Risk reduction policy. Source: Vanuatu Climate Change and Disaster Risk Reduction Policy (2016-2030)



Adaptation Priorities: Addressing Vulnerable Sectors

Effective climate change adaptation and disaster risk reduction (DRR) must address the specific vulnerabilities of Vanuatu's diverse communities and ecosystems. Priority actions are organized into the following themes and sectors:

1. Climate and Disaster Vulnerability and Multi-Sector Impact Assessment

- **Key Actions**:
    - Utilize vulnerability assessments, multi-hazard mapping, and participatory processes to design actions.
    - Base prioritization on criteria such as environmental impact, gender analysis, and cost–benefit analysis.
    - Develop early-warning systems tailored to local needs.
    - Address urban and rural issues equitably, avoiding maladaptive measures.

2. Integrated Climate Change Adaptation and Disaster Risk Reduction

- **Key Actions**:
    - Develop strategic policies at all levels incorporating climate and DRR elements.
    - Strengthen governance by ensuring multi-stakeholder participation, including government, civil society, and the private sector.
    - Promote integrated approaches in education, policy, and community planning.

3. Community-Based Adaptation and Disaster Risk Reduction

- **Key Actions**:
    - Engage communities through bottom-up planning, ensuring local leadership and ownership.
    - Include marginalized groups in decision-making and respect traditional knowledge systems.
    - Ensure initiatives provide social, environmental, and economic co-benefits.
    - Avoid over-reliance on external support by fostering community self-reliance.

4. Loss and Damage Mechanisms

- **Key Actions**:
    - Develop a loss and damage framework, integrating risk-sharing mechanisms like insurance.
    - Conduct loss assessments linked to vulnerability studies, particularly for critical sectors such as food security and ecosystems.

- Strengthen laws to climate-proof infrastructure and development projects.

5. Ecosystem-Based Approaches

- **Key Actions**:
  - Prioritize nature-based solutions such as coastal revegetation over hard infrastructure.
  - Integrate adaptation with conservation of taboos, heritage sites, and carbon sinks.
  - Build ecosystem service valuation into adaptation budgets and planning.
  - Align actions with existing policies like the Land Use Planning Policy and National Environment Policy.

Progress in Sendai Framework for Disaster Risk Reduction

Vanuatu has made significant progress in climate change adaptation (CCA) and disaster risk reduction (DRR) in alignment with the Sendai Framework for Disaster Risk Reduction. The following sections highlight the steps taken under each priority area.

Priority 1: Understanding Disaster Risk

Understanding disaster risk is critical for Vanuatu due to its geographical exposure to natural hazards and climate change. The government has been collecting and analyzing data to enhance policy and action plans aimed at reducing vulnerability. For example, temperature records for Efate have been collected since 1949, showing an increase in temperature, particularly in the south, while rainfall has decreased. The Pacific Islands Renewable Energy Programme (PIREP) and Pacific Islands Energy Policies and Strategic Action Planning (PIEPSAP) projects were completed to identify barriers and develop energy policies to address these challenges (GEF, UNDP, SPREP, 2007) (NACCC, 2007) (Republic of Vanuatu, 2014).

Priority 2: Strengthening Disaster Risk Governance to Manage Disaster Risk

Vanuatu has taken several steps to strengthen its DRR governance. The National Disaster Act, first published in 2000 and revised in 2019, is a crucial regulatory framework for DRR, establishing the National Disaster Management Office (NDMO), the National Disaster Committee (NDC), and other bodies at the provincial and municipal levels. Additionally, the Vanuatu Climate Change and Disaster Risk Reduction Policy (2016-2030) and the People's Plan (National Sustainable Development Plan 2016-2030) have provided a clear framework for implementing CCA and DRR actions in coordination with national and international stakeholders (Parliament of Vanuatu, 2020) (SPC, 2015) (Government of Vanuatu, 2016).

Priority 3: Investing in Disaster Risk Reduction for Resilience

Investments in DRR for resilience have been a priority for the government, with approximately 20% of the national budget allocated to infrastructure improvements, particularly in coastal areas vulnerable to disasters. The government has also promoted renewable energy initiatives like the National Green Energy Fund to enhance energy access, especially in rural areas. International funding has supported these initiatives, such as the USD 23 million Green Climate Fund grant to strengthen climate information services and USD 10 million from the World Bank for DRR development policies (Government of Vanuatu, 2019) (The World Bank, 2018) (SPREP, 2016) (The World Bank, 2019) (The World Bank, 2017).

Priority 4: Enhancing Disaster Preparedness for Effective Response and Recovery

The theme of "Building Back Better" has been a core element of Vanuatu's recovery efforts after major disasters like Tropical Cyclone Pam and the Ambae volcanic eruption. Measures included establishing breeding centers, creating fish nurseries, and distributing seedlings to aid communities in recovery. Infrastructure projects, such as renovating the Luganville Market House and strengthening the seafront in Port Vila, have improved resilience against future natural disasters (Australian Aid, 2018) (UNDRR, 2020) (Government of Vanuatu, 2010) (New Zealand Institute of Landscape Architects, 2019).

Priority Areas of Work

Disaster Risk Reduction in the Republic of Vanuatu

The priority areas of work summarized need to be carried out by the Government of Vanuatu in collaboration with other stakeholders (such as non-governmental organizations (NGOs), community-based organizations, development partners, and relevant government organizations). These include:

- Safeguard Traditional Knowledge and Heritage Sites: Promote and preserve cultural and traditional knowledge and conserve culturally significant sites. The Vanuatu Cultural Centre and NDMO should collaborate with civil society and NGOs to conduct awareness programs and record traditional knowledge to prevent its loss.
- Improve Critical Infrastructure: Enhance the resilience of critical infrastructure (water, transportation, telecommunications, education, healthcare) to ensure their functionality during and after disasters for life-saving services.
- Training and Capacity Building: Conduct disaster risk preparedness training, especially for isolated communities, to ensure they have the necessary skills and support systems when disasters occur.
- Improve Technical Capacity: Assess current technical capacity at national, provincial, and community levels to develop skills and competencies required for DRR and climate policy implementation.
- Inclusion of Marginalized Groups: Encourage the participation of marginalized groups (women, persons with disabilities, the elderly, and youth) in policy development, decision-making, and implementation, following the National Gender Equality Policy (2020-2030).
- Improve Economic Activities: Strengthen links between urban and rural businesses, promote internal trade between islands, increase production of niche commodities, and expand the tourism sector to create jobs and business opportunities.

- Enhance Multi-Hazard Early Warning System: Develop key components of early warning systems, including risk-informed systems, hydrological monitoring, weather forecasting, and governance improvements. Upgrade weather monitoring with advanced technologies like Doppler radar and automated data observations.
- Improve Data Management: Formalize data sharing mechanisms for early warning and response. Enhance observation stations and technical infrastructure to gather accurate data for climate change and disaster management.
- Conduct Risk Assessment: Perform comprehensive risk assessments covering hazards, vulnerability, exposure, and adaptive capacity, enabling better impact-based forecasting and early warning.
- Community-Based Disaster Risk Management (CBDRM): Identify and implement community-based adaptation and DRR measures through vulnerability and needs assessments, ensuring community involvement.

Adaptation challenges and gaps

The Vanuatu Climate Change and Disaster Risk Reduction Policy (2016-2030) highlights several adaptation challenges and gaps. The geographical remoteness of many islands and communities, combined with limited communication infrastructure and expensive transportation, poses significant barriers for stakeholders at national and provincial levels to effectively carry out disaster preparedness and response activities (SPC, 2015; Jackson et al., 2019; Australian Aid, 2018). Furthermore, poor coordination between non-governmental organizations (NGOs) and community-based organizations (CBOs) created bottlenecks during the TC Harold response, with some areas receiving no assistance and others being overwhelmed with support (Australian Aid, 2018; NDMO, 2021). While Vanuatu has developed significant meteorological forecasting skills, translating these forecasts into impact-based warnings remains a challenge, highlighting the need for an impact-based forecasting system as per the World Meteorological Organisation (WMO) guidelines (2015). Additionally, limited technical and human capacity at the local level hinders the implementation of Disaster Risk Reduction (DRR) activities, with literacy and numeracy levels further complicating efforts, alongside financial and technical constraints (Jackson et al., 2019; Australian Aid, 2018). Lastly, there is no effective institutional framework for managing the housing sector's recovery processes, as the country lacks approved building codes, land-use policies, and sufficient government finances to construct resilient housing. Financial assistance packages for disaster-affected households are also insufficient to meet post-disaster rebuilding needs (Government of Vanuatu, 2022).

Adaptation Strategies, Policies, Plans, Goals, and Actions

Implementation of Adaptation Actions

Vanuatu has demonstrated a proactive approach in addressing climate change adaptation through the implementation of several key policies and strategies, as well as international collaborations. These include:

Table 7: Vanuatu's Key Adaptation Plans and Goals

Adaptation Actions	Description
First Nationally Determined Contribution (NDC) (2020)	Highlights adaptation commitments across sectors like agriculture, water, and coastal management, aligning with the Paris Agreement's global goal.
Intended Nationally Determined Contribution (INDC) (2016)	Emphasizes adaptation measures in priority sectors, promoting initiatives to reduce vulnerability to climate-induced risks.
Climate Change and Disaster Risk Reduction Policy 2016–2030 (2015)	Integrates climate change adaptation and disaster risk reduction, focusing on improving resilience in vulnerable communities.
National Adaptation Programme for Action (NAPA) (2007)	Identifies immediate adaptation needs, prioritizing projects to address the vulnerability of critical sectors to climate impacts.

As in the Vanuatu Climate Change and Disaster Risk Reduction Policy 2016–2030, successful climate change adaptation and disaster risk reduction actions in Vanuatu require co-implementation that is inclusive and builds on both indigenous and externally derived knowledge. It is essential that activities are coordinated among multiple partners. Priority climate change adaptation and disaster risk reduction policy directives can be found at the sector level in various sector policies, plans, and strategies. Vanuatu is leading a regional shift in the way it integrates climate change and disaster risk reduction governance and implementation, resulting in more efficient service delivery and streamlined approaches. Relevant initiatives and programs must include an integrated climate change adaptation and disaster risk reduction approach by developing strategic documents at all levels, incorporating both climate change and disaster risk elements in an integrated and compatible way (e.g., government policies, provincial plans, community strategies, municipal plans, donor project designs, and budget frameworks). Furthermore, government agencies, civil society organizations (CSOs), the private sector, academia, communities, and individuals must take responsibility for identifying integrated adaptation and risk reduction priorities. It is also crucial to adhere to integrated and standardized approaches once initiatives have been endorsed by the National Advisory Board (NAB), incorporate an integrated curriculum approach into formal and non-formal education programs, and develop innovative partnerships, including those with the private sector, to integrate climate and risk reduction approaches and actions.

Adaptation Goals and Strategies

Vanuatu’s strategic goal for climate change and disaster risk reduction is focused on achieving resilient development. This approach aims to strengthen the nation’s capacity to absorb and recover from the shocks and stresses caused by climate and disaster events. The goal is central to the planning, decision-making, and project delivery processes across government and partner organizations. It aligns with the National Sustainable Development Plan 2016–2030, ensuring long-term sustainability and resilience in addressing climate-related challenges (Vanuatu Climate Change and Disaster Risk Reduction Policy, 2016–2030).

The National Climate Change Adaptation Strategy (NCCAS) is a key framework that enhances Vanuatu's resilience by reducing vulnerabilities and improving adaptive capacities. Its objectives include analyzing climate risks based on up-to-date climate change projections, offering prioritized and context-specific adaptation strategies, and recommending pathways to mitigate the impacts on land-based resources. The NCCAS also stresses the importance of public awareness, recognizes climate adaptation as a broad development issue that requires sector-wide engagement, and links adaptation with disaster risk reduction to ensure synergies. Strengthening governance and institutional frameworks is also emphasized as critical for the successful implementation of adaptation actions and for overcoming barriers to adaptation (National Adaptation Programme of Action - NAPA, 2007).

Vanuatu's long-term vision for climate change adaptation and mitigation is grounded in the constitutional responsibility to protect the nation’s wealth, resources, and environment for both present and future generations. This vision is in line with the National Sustainable Development Plan 2016–2030 and the Vanuatu Climate Change and Disaster Risk Reduction Policy 2016–2030, both of which prioritize good governance and outline strategic directions for future climate action. In May 2022, Vanuatu declared a Climate Emergency, reaffirming the urgency of addressing climate change as the most significant threat to the country’s livelihoods and wellbeing. Vanuatu’s enhanced Nationally Determined Contributions (NDCs) demonstrate the government’s highest ambition for climate action, including the protection of human rights, equity, and self-determination. Additionally, Vanuatu is exploring legal avenues, such as seeking an Advisory Opinion from the International Court of Justice, to protect the rights of current and future generations from the adverse effects of climate change (Vanuatu’s Revised and Enhanced First Nationally Determined Contribution 2021–2030).

Climate Impacts and Actions for Vanuatu's Key Sectors

Agriculture

Table 8: Climate Vulnerabilities and Adaptation Plans for Vanuatu's Essential Sectors

Sector	Affecting Climate Factors	Non-Climate Factors Affecting Production	Adaptation Plan
Cocoa Production	- High Temperature: Above 31°C affects growth. - Tropical Cyclones: Damage from strong winds. - Drought: Reduces yields. - Sunshine: Needs 4.5-6.5 hours/day. - ENSO: El Niño (dry) and La Niña (wet) affect rainfall.	- Cocoa Black Pod Disease: Controlled with chemicals and pruning. - Cocoa Pod Borer: Unknown links to climate. - Worker productivity and soil quality impact production.	- Use better farm management. - Plant in shaded areas. - Keep 75% shade cover. - Grow heat-resistant varieties. - Diversify with other crops.
Coffee Production	- Tropical Cyclones: Major damage from TC Pam and recent storms. - Droughts: Low moisture reduces yield. - Extreme Rainfall: Causes waterlogging. - Extreme Temperature: Stress from temps over 30°C. - ENSO: Affects rainfall patterns.	- Pests: Coffee Leaf Rust and coffee berry borer issues. - Pollinators: Temperature sensitivity; need diversity. - Volcanic Acid Rain: Damages plants. - Socio-Economic Factors: Affect smallholder livelihoods.	- New Practices: Use shade trees. - Farm in Higher Areas: Move to elevated locations. - Breed Varieties: Develop heat-tolerant types. - Diversify Crops: Include other crops. - Improve Conditions: Mulch and prune. - Change Aspect: Reduce hot sun exposure. - Plant Cover Crops: Where moisture is adequate.
Root Crops	- Night-Time Temperature: Above 21°C linked to TLB. - Rainfall: Possible 12% decrease. - Drought: Can reduce yields. - Tropical Cyclones: Damage from storms. - Sea Level Rise: Salinity risk. - ENSO: Affects rainfall and cyclones.	- Socio-Economic Factors: Affect livelihoods. - Pests: Risks from beetles and armyworms. - Transportation: Impacts storage and quality.	- Make flour from damaged cassava. - Use new or traditional farming methods. - Farm on higher ground. - Grow heat-tolerant varieties. - Diversify crops. - Use TLB-resistant taro varieties.

	Tropical Cyclones: Severe damage from cyclones like TC Pam (2015) and TC Harold (2020). Temperature: Ideal mean is 28°C; above 33°C can stress plants. Drought: Coconuts can survive drought, but prolonged drought delays nut production. Sea Level Rise: Affects coastal palms through salinity and inundation.	- Pests: Coconut rhinoceros beetle and leaf beetle risks increase. - Socio-Economic Factors: Worker productivity and soil quality impact management. - Transport: Road damage affects market access.	- Replant older palms. - Use selective breeding for resilience. - Plant trees in groups of three (G3PH technique).
Kava	- Tropical Cyclones: Susceptible to storm damage. - Temperature: Sensitive to extreme heat. - Drought: Older plants tolerate limited rainfall; younger plants do not. - Extreme Rainfall: Waterlogging harms plants.	- Pests: Kava dieback from cucumber mosaic virus. - Socio-Economic Factors: Worker productivity and soil quality impact management. - Transport: Road damage affects market access.	- Plant windbreaks for shelter. - Use single-node technique for multiplication after disasters. - Reduce weeding during cyclone season.
Banana	- Tropical Cyclones: Severe damage from storms. - Drought: Some varieties tolerate drought. - Extreme Rainfall: Waterlogging leads to disease. - Temperature: Heat affects flowering and bunching.	- Pests: Black leaf streak disease (BLSD) risks increase. - Socio-Economic Factors: Worker productivity and soil quality impact management. - Transport: Road damage affects market access.	- Use the “Mara Technique” to preserve during cyclones. - Apply the “Laufasi Technique” for replanting. - Cut leaves/stems to reduce cyclone impact; support stems during cyclones (category 1-2).

Fisheries

Sector	Affecting Climate Factors	Non-Climate Factors Affecting Production	Adaptation Plan
Coral	- Sea Level Rise: Slower coral growth due to global warming. - Tropical Cyclones: Damage from storms, especially to shallow reefs. - Extreme Rainfall: Leads to low salinity and nutrient-rich waters.	- Invasive Species: Disrupt native species and water clarity. - Over-Fishing: Depletes key reef species. - Water Quality: Poor management reduces water quality.	- Limit nutrient and sediment flow to reefs. - Maintain algae-grazing fish populations. - Use marine protected areas (MPAs). - Identify high climate vulnerability reefs.

	- Solar Radiation: High radiation worsens coral bleaching. -Ocean Acidification: Decreases coral calcification. - ENSO: Affects sea surface temperature and cyclone frequency.	- Disease Outbreaks: Affect coral and associated ecosystems.	- Protect less exposed reefs as refugia. - Reduce human activity threats. - Complement MPAs with climate policies.
Seagrass	- Sea Level Rise: May cause seagrass migration. - Tropical Cyclones: Wave surge strips leaves and uproots seagrass. - Extreme Rainfall: Causes low salinity and increased sediment, leading to seagrass loss. - ENSO: Affects sea surface temperature and sea levels; exposes seagrass to higher temperatures.	- Land-Use Planning: Unsustainable coastal development increases sediment and pollution. - Low Light Levels: Seagrass is sensitive to low light and high temperatures.	- Strengthen risk assessments and use in planning. - Support conservation projects like Dugong and Seagrass Conservation. - Continue long-term seagrass monitoring. - Protect and manage seagrass species. - Support seagrass-related research and monitoring. - Recognize seagrass as a key provider of ecosystem services.
Sea Turtles	- Sea Level Rise: Affects nesting sites due to inundation and erosion. - Tropical Cyclones: Stronger waves and flooding harm nesting sites. - Rainfall: Cooler nest temperatures in wet years result in more males. - ENSO: Affects sea surface temperature, sea levels, and cyclone frequency.	- Predators: Monitoring of nesting sites for predators (e.g., dogs). - Coastal Development: Poor planning threatens nesting site sustainability. - Sand Temperature: Impacts gender ratios, varies by beach orientation and shading.	- Monitor sand temperature at nesting sites. - Use models to predict sand temperature changes and gender ratios. - Protect male-producing regions or relocate nests. - Use shading, vegetation, or water sprinkling to control sand temperature.

Water

Sector/region	Affecting Climate Factors	Non-Climate Factors Affecting Production	Adaptation Plan
Greater Port Vila	- Extreme Wind Gusts: Cyclones can push debris into drains, reducing drainage capacity. - Sea Level Rise: Combined with river flooding, this can	- Exposure: More people, assets, and ecosystems in flood-prone areas. - Vulnerability: Influenced by age, health, finances, and access to services (water, hospitals, etc.). Poor	- Set up early warning systems for floods and cyclones. - Use flood risk assessments to guide investment in mitigation.

	worsen drainage and increase flood risk.	building standards increase vulnerability.	- Update and enforce national building codes for flood resilience. - Ensure proper disaster preparedness and response through NDMO.
Luganville and the Sarakata River Catchment	- Extreme Wind Gusts: Cyclones can block drains with debris, reducing drainage capacity. - Sea Level Rise: Combined with river flooding, it can increase flood hazards.	- Exposure: Population growth and development in flood-prone areas increase risk. - Vulnerability: Factors like age, health, finances, and poor building standards affect vulnerability.	- Implement early warning systems and evacuation plans. - Update the Building Code to make buildings more flood-resilient. - Improve flood forecasting and monitoring systems (e.g., Sarakata River gauge). - Enhance hydrological models for flood forecasting. - Coordinate with stakeholders for flood risk management.
Water Security	- Temperature and Evapotranspiration: Higher temperatures increase evaporation and reduce soil moisture and streamflow. - Tropical Cyclones: Can damage water infrastructure, limiting access to clean water. - Sea Level Rise: Increases saltwater intrusion into wells near the coast. - ENSO: Affects rainfall and drought patterns; El Niño leads to drier conditions, while La Niña brings wetter conditions.	- Socio-Economic Factors: Communities with limited access to water sources are more vulnerable. - Increased Water Demand: Population growth and tourism raise water needs and stress local supplies. - Dependence on Agriculture: Communities relying on crops and livestock are more exposed to water shortages.	- Raise climate change awareness and provide training for water sector experts. - Supply rainwater tanks for homes with adequate roof catchments. - Set up early warning systems for drought preparation. - Use mobile desalination units for fresh water in drought-affected areas.

Tourism

Sector	Affecting Climate Factors	Non-Climate Factors Affecting Production	Adaptation Plan
Coastal Inundation Affecting **Tourist Bungalows**	- Temperature: Warmer days and nights may require better ventilation and cooling. - Coastal Inundation: Sea level rise and extreme sea level events can undermine foundations and access.	- Vertical Land Movement: May impact sea level changes. - Poor Catchment Management: Increases vulnerability and exposure.	- Update the Vanuatu Bungalow Standards Guide to improve resilience. - Use insurance incentives for resilient buildings. - Consider no-build zones and elevated buildings.

	- Extreme Rainfall: Increased intensity; bungalow design must consider this. - ENSO: Affects rainfall and sea levels; La Niña can lead to coastal flooding.	- Coastal Erosion: Land clearing may expose bungalows to hazards. - Funding: Lack of access to funding for risk reduction.	- Study local wave, tide, and wind interactions for risk assessment. - Integrate climate actions in tourism policies. - Encourage local participation in tourism planning and development.
Tropical Cyclones Affecting **Design Of Tourist Bungalows**	- Temperature: Warmer days/nights require better ventilation and cooling systems (e.g., fans, air conditioning). - Extreme Rainfall: Increased rainfall from cyclones can damage bungalows and affect access to sites. - Tropical Cyclones: Fewer cyclones expected, but more severe ones may occur; bungalow design needs to accommodate this. - ENSO: Influences cyclone frequency and intensity, with more severe storms projected.	- Reconstruction Challenges: Limited funding and geography make rebuilding difficult after cyclones. - Traditional Knowledge: Local knowledge can aid recovery and rebuilding efforts. - Building Materials: Limited availability of local materials can hinder construction.	- Update building standards for cyclone resilience and incorporate climate risks into designs. - Revise the Vanuatu Building Code (2000) to include cyclone category standards. - Update the Vanuatu Bungalow Standards Guide (2013) to improve resilience to climate impacts. - Repair and utilize traditional cyclone shelters (nakamals). - Promote use of local materials and building techniques for affordability and cultural relevance. - Use lightweight and flexible building materials for better resilience in storms.

Infrastructure

Sector	Affecting Climate Factors	Non-Climate Factors Affecting Production	Adaptation Plan
Road Infrastructure	- Temperature: Higher temperatures may require more heat-tolerant pavement materials to prevent rutting and cracking. - Tropical Cyclones: Debris can block roads and drains, decreasing accessibility. - Extreme Rainfall: Increased flooding can lead to road subsidence and landslides, especially on unpaved surfaces. - ENSO: Affects sea levels and cyclone frequency;	- Poor Catchment Management: Inadequate management increases flooding risks. - Road Surface Material: Type and quality of materials (asphalt, gravel) impact resilience. - Traffic Load: Heavy trucks vs. smaller vehicles affect road wear.	- Modify and elevate roads, use sandbags, and implement rapid clean-up responses. - Use design standards from the Vanuatu Resilient Roads Manual. - Explore engineering options like groynes and seawalls. - Understand local wave, tide, and wind interactions for better adaptation strategies.

	more extremes are projected in the future.		- Consider concrete pavements for low-volume roads (<400 vehicles/day).
Vanuatu Airports	- Temperature: High temperatures can melt tarmac and increase AC demand. - Lightning: Disrupts airport operations. - Cyclones: Extreme winds can damage infrastructure and lead to closures. - Wind: Affects runway usability. - Sea Level Rise: Floods low-lying tarmacs and facilities. - ENSO: Influences rainfall and weather patterns; El Niño causes droughts and La Niña brings heavy rains.	- Exposure: Increased population and tourism demand may necessitate new or larger airports, increasing vulnerability. - Vulnerability: Factors like age, health, and financial resources impact the ability to cope with climate risks.	- Repair and maintain airports post-cyclones; ensure backup power systems. - Implement early warning systems for floods and cyclones. - Conduct flood risk assessments to identify high-risk areas. - Strengthen airport infrastructure to withstand Category 5 winds. - Update and enforce a national building code for climate resilience.
Electricity Demand In Efate	- Extreme Rainfall: Flooding can damage electricity infrastructure, disrupting distribution. - Tropical Cyclones: High winds can damage generation and distribution infrastructure, including wind turbines and solar panels. - Solar Radiation: High solar radiation can enhance generation; low solar radiation can limit it. - ENSO: Affects rainfall and temperature; El Niño leads to drier conditions while La Niña brings wetter conditions.	- Socio-Economic Growth: Population and industry growth may increase demand for electrical appliances. - Tourism: Increased tourism raises electricity demand for cooling and appliances in hotels. - Transport Electrification: Transitioning to electric vehicles increases demand unless offset by efficiency improvements. - Industry Development: New industries may drive demand for electricity.	- Improve residential energy efficiency with better insulation and cooling design. - Implement urban greening initiatives to mitigate heat. - Use passive cooling strategies, such as solar shading and improved ventilation. - Increase access to renewable energy sources to meet rising demand sustainably. - Communicate findings to stakeholders to promote adaptive actions.

Climate Change Acts, Plans, And National Targets

Table 9: Vanuatu's Climate Policies and Objectives. Source: The Republic of Vanuatu. (2020). *Third National Communication to the United Nations Framework Convention on Climate Change*.

Policy/Plan	Focus	Key Objectives
Environmental Management and Conservation Act	Biodiversity, environmental impact assessments,	Addresses climate change challenges, defines climate change, requires consideration of climate change in decision-making, and mandates a climate change database.

	administration, bio-prospecting laws, and CCAs	
Forestry Rights Registration and Timber Harvest Guarantee Act	Forestry rights, carbon sequestration rights	Regulates forestry rights, defines carbon sequestration rights, and includes regulations on sandalwood products.
Nationally Determined Contributions (NDCs)	Adaptation and mitigation strategies	Sets ambitious targets for renewable energy, emission reduction, and forestry sector mitigation. Aims to achieve 100% renewable energy in the electricity sector by 2030 and reduce emissions in all sectors except agriculture and forestry. Adaptation targets in Vanuatu include improving food security through sustainable agriculture, implementing rainwater harvesting and water management policies, promoting climate-resilient tourism, establishing community-based marine resource management, and conserving forests through sustainable forestry and REDD+ initiatives. These targets aim to enhance climate resilience while preserving ecosystems and cultural heritage
National Adaptation Programme of Action (NAPA)	Priority adaptation activities	Proposes priority projects in agriculture and food security, water management, sustainable tourism, community-based marine resource management, and sustainable forestry management.
National Adaptation Plan (NAP)	Strengthening adaptation planning and governance	Aims to develop a national adaptation plan with a focus on institutional capacity, governance, and planning.
Vanuatu National Energy Roadmap	Energy sector development	Proposes a long-term development plan for the energy sector to achieve secure, affordable, widely accessible, high-quality, clean energy services for national growth and development.
Vanuatu Strategic Tourism Action Plan	Tourism development	Provides analysis and guidance for tourism in Vanuatu, acknowledges climate change but does not address specific risks in detail. Includes developing a sustainable tourism policy that incorporates climate change and eco-tourism.
Vanuatu Climate Change and Disaster Risk Reduction Policy	Climate change and disaster risk reduction	Outlines strategic priorities for governance, finance, knowledge, information, adaptation, low-carbon development, and response and recovery.
Vanuatu Framework for Climate Services	Climate services	Aims to ensure Vanuatu's climate services meet world-class standards and are accessible to all end-users.
Vanuatu Forest Policy	Forestry sector development	Targets integration of climate change adaptation issues into forestry sector planning and activities.
REDD+	Reducing emissions from deforestation and forest degradation	Supports the Department of Forests in designing and training for a new forest inventory protocol and finalizing the Vanuatu REDD+ Readiness proposal.
National Water Strategy	Water resources management	Recognizes climate change's potential impacts on water availability and seeks to ensure sustainable and equitable access to safe water.
Vanuatu National Fisheries Sector Policy	Fisheries sector development	Addresses climate change and disaster risk reduction by investigating impacts on fisheries resources and habitats.

National Ocean Policy	Ocean management	Includes climate change and disaster risk reduction as a priority area and outlines actions to promote efficient and effective efforts.
Vanuatu National Biodiversity Strategy and Action Plan (NBSAP)	Biodiversity conservation	Prioritizes community conservation areas, aims to expand protected area coverage, and improve management effectiveness.
Agriculture Sector Policy	Agriculture sector development	Mainstreams climate variability, climate change, and disaster risk reduction in all agriculture initiatives and developments.
National Livestock Policy	Livestock sector development	Addresses climate change adaptation and disaster reduction by identifying a lack of knowledge and outlining desired progress.
Gudfala Kakae Policy	Food security	Promotes healthy, locally sourced nutrition/food supply and includes objectives related to climate-smart agricultural practices.
National Environment Policy and Implementation Plan (NEPIP)	Environmental protection	Aims to build a strong and resilient nation in the face of climate change and disaster risks.
National Waste Management and Pollution Control Strategy	Waste management and pollution control	Promotes an environmentally sustainable Vanuatu through waste reduction, collection, reuse, recycling, and treatment.
National Gender Equality Strategy	Gender equality	Highlights the differentiated vulnerability of women to climate change due to their involvement in the subsistence economy.
Biosecurity Policy	Biosecurity	Addresses climate change by mitigating against damages caused by pests due to pest-favored climatic conditions.
Vanuatu Sustainable Tourism Policy	Sustainable tourism	Aims to develop and manage a sustainable and responsible tourism industry that protects and celebrates Vanuatu's environment, culture, and people.

Projects

According to the *Third National Communication to the UNFCCC,* Vanuatu's priorities stemming from its National Adaptation Programme of Action (NAPA) and sector policies, several projects with climate change adaptation goals have been implemented or are currently being implemented in the country. These projects aim to enhance resilience, strengthen governance, and support communities in addressing the impacts of climate change. The following table outlines these projects, highlighting their brief descriptions and funding sources.

Table 10: Climate Change Adaptation Projects in Vanuatu

No.	Project Name	Brief Description
1	Coping with Climate Change in the Pacific Island Region (CCCPIR)	Adaptation support to Government of Vanuatu line agencies in components of Climate Governance/Institutions, Policy Mainstreaming, Education, Renewable Energy, Adaptation Trials, Disaster Risk Reduction
2	Increasing Resilience on Climate Change and Natural Hazards (IRCCNH) Project	Institutional strengthening; Technology investment and transfer; Training; Community capacity building. Implemented by DLA, NDMO, VARTC, Rural Water Supply, and Agriculture. (2013 – 2018)
3	Managing Disaster Risk Reduction (MDRR)	Institutional strengthening; Technology investment and transfer; Training; Community capacity building. Implemented by NAB / PMU / VMGD. (2013-2015)
4	Global Climate Change Alliance – Vanuatu Project (GCCA-V)	Institutional strengthening; Mainstreaming; Data collection; Policy development. (2012 – 2014)
5	Pacific Adaptation to Climate Change (PACC)	A regional project developed as a follow-up to the CBDAMPIC project implemented in Vanuatu by NACCC from 2002 to 2005. Focused on Epi Island, Varsu Area Council with a major focus on the resilience of roadways. (2009 - 2014)
6	Pacific Risk Resilience Programme (PRRP)	Strengthening governance mechanisms for Disaster Risk Management (DRM) and Climate Change Adaptation (CCA). Based on Tanna, Tafea Outer Islands, Santo, and Emae. (2013-2016)
7	Coastal Community Adaptation Project (C-CAP)	Community-based CCA, planning and implementation of plans based in Efate offshore islands and on Tanna Island. Implemented by DAI / USP. (2013-2018)
8	Adaptation to Climate Change in the Coastal Zone in Vanuatu (V-CAP)	Focus on community-based climate change adaptation measures at 6 different sites with infrastructure resilience, upland management, and coastal resource management components. Early warning systems and policy support as well. Implemented by PMU, PWD, Environment, Agriculture, and Fisheries & Forestry. (2014-2019)
9	A2C2 Climate Change Awareness Project	Research, Media Production, Community Awareness, Educational Capacity Building, Mentoring. Implemented by Apidae Development Innovations. 6 secondary schools around Port Vila. Starts July 2014 (6 months)
10	Natural Solutions to Climate Change in Pacific Islands Region: Implementing Ecosystem-based Adaptation	Education and awareness of ecosystem approaches. Support of ridge to reef and integrated coastal zone management planning. Implemented by Secretariat of the Pacific Regional Environment Programme in collaboration with SPC-GIZ CCCPIR. Port Vila and surrounding areas plus one site in Tafea Province. (2014 – 2019)
11	AECOM Pacific Australia Climate Change Science and Adaptation Planning (PACC SAP) Program	Infrastructure - Economic analysis of climate change adaptation options to protect low-lying settlements and critical infrastructure. (2014)

12	Restoration of Ecosystem Services and Adaptation to Climate Change (RESCCUE)	Community-based coastal resource management and monitoring, waste management, and conservation trust based in 37 communities of North Efate. Implemented by Opus, C2O, Landcare Research, Live & Learn (2015-2018)
13	Climate Information Services for Resilient Development in Vanuatu	Provide people and organisations with timely, tailored climate-related information and tools to reduce the impacts of climate change on lives, livelihoods, and property. (2018-2022)

Some current projects are:

- **Strengthening coastal biodiversity conservation and management in Pacific Island Countries.** One such initiative aims to map Seagrass and Mangrove resources across four partner nations, assessing their carbon storage capabilities and associated ecosystem services. This project will create national inventories that support governments in developing incentives for sustainable management and rehabilitation efforts, aligning with Nationally Determined Contributions (NDCs) and National Adaptation Programmes of Action (NAPAs). By collaborating with national and regional partners, the project addresses the urgent need for consistent data collection on these vital coastal ecosystems.
- **Restoring and Protecting Biodiversity, Coastal Landscapes, and Climate Change Resilience through Nature-Based Solutions, Women and Youth Entrepreneurship in Vanuatu.** This project aims to enhance climate resilience, food security, and livelihoods in Vanuatu's coastal communities through community-led nature-based solutions (NBS). Targeting 22,500 beneficiaries across 5,000 households, it prioritizes women and youth. The project follows a participatory approach, engaging stakeholders to identify NBS and foster entrepreneurial opportunities in sustainable tourism and fisheries. It unfolds in three phases: Phase I assesses biodiversity loss; Phase II establishes women and youth-led NBS entrepreneurship; and Phase III develops gender-sensitive ecosystem management policies while promoting public communication on NBS. Key activities include community consultations, training, tree propagation, and knowledge-sharing workshops.
- **Women's Resilience to Disasters Programme (WRD).** Funded by Australia, strengthens the resilience of women and girls against disasters to promote sustainable communities. Implemented in Vanuatu, Kiribati, and Fiji, it focuses on developing gender-responsive systems tailored to local needs and fostering women's leadership in disaster risk reduction. Key outcomes include establishing gender-responsive policies and empowering women and girls to withstand and recover from disasters. The program prioritizes collaboration with women's organizations and aligns with international frameworks like Agenda 2030 and the Sendai Framework.
- **Vanuatu Klaemet blong Redy, Adapt mo Protekt (VanKIRAP)** Project enhances climate resilience in Vanuatu by mainstreaming Climate Information Services (CIS) across tourism, agriculture, infrastructure, water, and fisheries. It focuses on building capacity to manage climate data, developing practical CIS tools, and improving information dissemination. The project aims to address information gaps at all levels, providing reliable climate data to support resilient development.

How best available science, gender perspectives and indigenous, traditional and local knowledge are integrated into adaptation

Climate and Gender in Vanuatu

Climate change and its associated disasters have gendered impacts, and research has consistently shown that women and girls are disproportionately affected. For instance, the United Nations Sendai Framework for Disaster Risk Reduction (ratified by 101 countries) highlights that women and girls face heightened risks in the face of climate disasters (UNDRR 2015). This is supported by numerous studies from Pacific Island nations, including Vanuatu, where reports have shown the exacerbation of gender inequalities during climate-induced crises (CARE 2015, 2017). Despite the recognition of these gendered impacts, feminist scholars warn against portraying women as a homogeneous group of vulnerable individuals. While global policies may acknowledge the challenges women face, it is critical to avoid oversimplified views of women as inherently vulnerable or solely victims of climate change. Researchers like Djoudi et al. (2016) emphasize the importance of avoiding the “feminisation of victimisation,” and instead highlight the need to consider intersectionality. Factors such as age, geographical location, education, and socioeconomic status all contribute to the complexity of gendered experiences during climate crises (Crenshaw 1991).

In Vanuatu, gender relations are deeply influenced by cultural and religious norms, often placing women in subordinate positions. These power dynamics are exacerbated during climate disasters, as resource distribution and recovery policies frequently fail to account for gender-specific needs, leading to further marginalization of women. Despite these challenges, the resilience and agency of Ni-Vanuatu women are evident in their proactive contributions to climate change mitigation and adaptation efforts. By leveraging their knowledge of the environment and community dynamics, they build resilience and ensure the survival of their families. For instance, after the destruction caused by Tropical Cyclone Harold in 2020, women like Anna Ishmael prioritized rebuilding their homes, using durable materials such as iron sheets and timber to create safe and secure shelters. This not only provided immediate relief but also reduced the need to depend on evacuation centers during heavy rains. Access to clean water is another critical challenge addressed by women-led initiatives. The Woman I TokTok Tugeta (WITTT) network has supported the installation of water tanks in homes, sparing women the arduous task of walking kilometers daily to fetch water. Leontin Michael, a woman with disabilities, expressed her relief when a water tank was installed at her house, stating, “My prayers have been answered. I no longer have to walk kilometers to get clean and safe water.” Similarly, Rurael Andrew, a mother, shared how having a water tank at home reduces stress and ensures access to clean water even during cyclones, when traditional water sources become contaminated.

Women are also strengthening their homes against climate impacts. For example, Linda Toa and Wodom Matahoso reinforced their houses with iron sheeting, improving their resilience to unpredictable weather. Beyond physical infrastructure, Ni-Vanuatu women contribute to community resilience through innovative communication platforms like "Women Wetem Weta" (Women’s Weather Watch). This women-led SMS-based system delivers early disaster warnings and practical information, reaching over a quarter of Vanuatu's population and enabling timely preparation for natural disasters. Inclusivity is a cornerstone of these efforts, as seen in the WITTT Sunshine initiative, which focuses on supporting women and girls with

disabilities. By addressing their unique needs in disaster preparedness and response, this program ensures their voices are heard and rights are upheld. Additionally, the WITTT network empowers women economically by providing access to loans and resources. This reduces financial dependence and vulnerability to violence, enabling women to lead more independent and resilient lives.

Climate disasters occur within pre-existing socioeconomic and political contexts where women's rights and autonomy are often limited, exacerbating gender inequalities. These disparities are further intensified by resource distribution processes and gender-insensitive policies in post-disaster scenarios, disproportionately affecting women in low-GDP countries (Alston, 2020; Kinnvall & Rydstrom, 2019; UNDP, 2014). Research on women in Vanuatu examines these dynamics, adopting a gendered perspective to explore how climate change impacts women and their families. This approach highlights the significant understanding women possess about climate change and their active efforts to mitigate its effects, challenging oversimplified narratives seen in some COP 27 responses.

Ultimately, climate change must be examined through a gendered lens, as the impacts are unevenly distributed across different groups. By focusing on the lived experiences of Vanuatu women and acknowledging their resilience, it becomes clear that any effective climate adaptation and mitigation strategy must consider the nuanced roles and contributions of women.

Integration of Knowledge

Vanuatu Climate Change and Disaster Risk Reduction Policy for 2016-2030, seeks to meet stakeholders' needs for climate change and disaster risk knowledge and information, enhancing communication-related interventions that empower appropriate climate and disaster risk management actions. Vanuatu's information management for climate change and disaster risk management will be improved to enable informed decision-making for planning, development, and disaster operations, as well as the development of accurate community awareness tools. To strengthen existing systems for improving information capture, access, and application, the National Advisory Board's (NAB) information, education, and communication endorsement process will be utilized by all climate change and disaster risk reduction material developers. The effectiveness of these materials and communications will be monitored, ensuring participation from all relevant government and stakeholder bodies, including provincial governments and the National Statistics Office, in information management processes. Up-to-date project information, resources, reports, events, and contacts will be made accessible on the NAB portal, with technology transfer and methodologies adapted for the Vanuatu context.

People in Vanuatu possess long-held traditional practices to address temperature and rainfall variability, cyclones, and geological hazards, which have begun to be systematically documented and incorporated into planning processes. However, further work is urgently required. Stakeholders at provincial and community levels place high importance on respecting, recording, and sharing traditional knowledge, including traditional early warning and coping mechanisms. To build on and share this knowledge, actions will be taken to collect, record, and incorporate traditional knowledge into planning while respecting appropriate cultural protocols. Traditional knowledge will be made accessible to decision-makers,

considering intellectual property rights, through databases and training, and will be included in formal and informal school curricula. Existing traditional knowledge strategies will be further developed and captured on the NAB portal and by the Vanuatu Cultural Centre.

Significant progress has been made in collaboration among agencies and in using networks to collect and disseminate information. However, further work is required, particularly in building linkages with regional educational and learning networks. Awareness sessions provide valuable information to small audiences at the provincial and community levels, and this approach can be enhanced by utilizing new information and communications technology tools, optimizing resource use, and fostering collaboration across organizations. To develop and enhance knowledge management systems, actions will include acknowledging and promoting existing valuable knowledge on climate change and disaster risk reduction, developing new materials relevant to the local context, and creating standardized technical messages for enhanced decision-making. Existing networks and knowledge-sharing mechanisms will be strengthened, and options for national-scale climate change and disaster risk reduction summit meetings and events will be explored. Additionally, new knowledge management systems will be initiated to enhance the accessibility of information and communications technology tools. These actions will ensure that knowledge is effectively integrated into climate change and disaster risk management strategies in Vanuatu, fostering a more resilient society.

Nature-Based Solutions to Climate Change Adaptation

According to Kiddle et al. (2021) in their review article *Nature-Based Solutions for Urban Climate Change Adaptation and Wellbeing: Evidence and Opportunities From Kiribati, Samoa, and Vanuatu.* Nature-Based Solutions (NbS) in Vanuatu play a crucial role in addressing climate change adaptation by integrating ecological health and human well-being. These solutions prioritize ecosystem restoration and protection, recognizing that healthy ecosystems provide vital services such as coastal defense, flood control, and food security. Key initiatives include mangrove rehabilitation to safeguard coastal areas from erosion and storm surges, agroforestry systems that enhance soil health and ensure food security, and the establishment of Educational Managed Marine Areas (EMMAs) to protect marine biodiversity and support sustainable fisheries. Watershed management projects help restore degraded landscapes, improving freshwater availability and mitigating flooding, while forest landscape restoration efforts combat deforestation, increase carbon sequestration, and offer sustainable materials for local use. Central to these initiatives is the integration of traditional ecological knowledge, ensuring that solutions are culturally appropriate and sustainable. Despite resource and capacity challenges, Vanuatu demonstrates the potential for NbS to deliver cost-effective and multi-benefit approaches to climate adaptation. Expanding these efforts requires collaborative governance, innovative financing, and alignment with frameworks like the IUCN Global Standard for NbS to guide implementation and scaling.

In Vanuatu, climate change adaptation is a core priority reflected in national policies such as *Vanuatu 2030: The People's Plan* and the *Climate Change and Disaster Risk Reduction Policy 2016–2030*. These frameworks emphasize disaster risk reduction (DRR), community-based adaptation (CbA), and ecosystem-based approaches as essential strategies for enhancing resilience. NbS initiatives in Vanuatu include mangrove rehabilitation for coastal protection

and biodiversity benefits, forest restoration to combat deforestation and improve carbon sequestration, and watershed management to enhance freshwater availability.

However, adaptation efforts have faced challenges, particularly with CbA projects. Studies, such as the evaluation of 15 CbA initiatives in Vanuatu by Westoby et al. (2020), highlight shortcomings in sustainability and local engagement. Many projects were led by external experts with limited community participation, resulting in interventions that did not fully align with local needs or contexts. This underscores the importance of designing adaptation efforts that are community-led and incorporate local knowledge and socio-cultural systems.

Research by Trundle (2020) further demonstrates the significance of understanding sub-city dynamics in urban adaptation efforts, using Port Vila as an example. Informal communities have shown resilience through traditional knowledge, ecosystem service maintenance, and kinship networks, suggesting that urban adaptation strategies must integrate localized and culturally grounded practices. These findings reinforce the need for inclusive, context-sensitive, and locally driven approaches to adaptation, ensuring the longevity and success of climate resilience efforts in Vanuatu.

Stakeholder Involvement and Responsibilities

The roles and responsibilities of key stakeholders in climate change and disaster risk reduction in Vanuatu are vital to the successful implementation of policies and initiatives. Vanuatu's national government plays a central role in managing climate change and disaster risk reduction activities throughout the country, primarily through the National Advisory Board (NAB), its key decision-making and advisory body. The national government enacts legislation, such as the Meteorology Act 1989 and National Disaster Act 2000, and engages in global and regional negotiations while collaborating with international governments and donors on climate change and disaster risk reduction.

The Ministry of Climate Change (MCC) is responsible for leading the implementation of climate change policies, hosting the NAB Secretariat, and overseeing various departments such as the Vanuatu Meteorology and Geo-Hazards Department (VMGD), Department of Energy, Department of Environment, and the National Disaster Management Office. MCC engages with other government agencies, civil society, provincial governments, and the private sector to drive climate change and disaster risk reduction activities across sectors.

Other national government agencies also play significant roles in the climate change space. Due to the cross-cutting nature of climate change and disaster risk reduction, these agencies lead efforts in agriculture, forestry, fisheries, infrastructure, health, education, and tourism, aligning their respective portfolios with national climate priorities.

At the subnational level, provincial governments, municipal councils, and area councils are crucial in implementing and facilitating climate change and disaster risk reduction activities. Provincial plans increasingly incorporate these actions into their development agendas, ensuring alignment with the Decentralization Act.

Traditional chiefs are recognized as influential community leaders. They help to inform and mobilize their communities on climate change and disaster-related issues, representing their villages in various forums. Communities themselves hold a wealth of knowledge regarding resilience and traditional practices, contributing to climate change adaptation through their capacities and governance systems. Inclusive community participation ensures that their needs are heard and integrated into broader climate change and disaster risk management efforts.

Civil society organizations (CSOs) are key partners, playing active roles in climate change initiatives through networks such as the Vanuatu Climate Action Network and the Vanuatu Humanitarian Team. CSOs work closely with the government and other stakeholders to develop and implement climate change programs. They also contribute to advocacy, decision-making, and disaster response efforts through recognized structures such as the NAB and the cluster system for disaster recovery. Vanuatu Red Cross, in particular, has a unique role in partnering with the government on humanitarian efforts in disaster preparedness, response, and recovery.

Donors and development partners such as international governments, UN agencies, and regional organizations are essential to supplement Vanuatu's resources. These partners align their contributions with Vanuatu's national priorities, providing funding for climate change and disaster risk reduction initiatives and urgent response and recovery efforts.

Finally, the private sector plays a critical role in Vanuatu's development, with opportunities to invest in climate-proofed infrastructure, renewable energy, and other sectors such as agriculture and tourism. Public-private partnerships offer potential for enhanced collaboration in climate change mitigation and disaster risk management. The private sector is also responsible for adhering to environmental standards and regulations, ensuring sustainability in their operations while providing products and services that support the government in addressing communication and disaster preparedness challenges across the country.

Monitoring and evaluation of adaptation actions and processes

In order to ensure the effectiveness of adaptation actions and facilitate transparent reporting, Parties are encouraged to establish or use domestic systems for monitoring and evaluating the implementation of such actions. These systems will help track the progress, impact, and effectiveness of adaptation measures, while providing valuable insights to guide future efforts.

Strengthening Monitoring and Evaluation for Climate Adaptation

Effective monitoring and evaluation (M&E) systems are crucial for good governance in Vanuatu. To enhance accountability and improve climate change and disaster risk reduction initiatives, it is essential to develop nationally aligned and relevant M&E processes. This involves integrating M&E into project and program design across government agencies and

stakeholder groups. Collaboration among government entities, civil society organizations (CSOs), development partners, and the private sector is necessary to strengthen M&E practices at national, provincial, and local levels.

Additionally, the Department of Strategic Policy Planning and Aid Coordination should lead the development of a comprehensive Monitoring and Evaluation (M&E) framework to ensure consistency and provide guidance for climate resilience efforts. Currently, a systematic M&E framework has not been fully developed in Vanuatu. However, the government is taking steps to address this gap. Efforts are underway to establish a more robust framework, with training on climate change and disaster monitoring and evaluation provided to relevant officers within government and other agencies to build capacity. Utilizing the results of M&E activities will be crucial for improving the planning and implementation of future initiatives, ultimately leading to more effective responses to climate challenges in Vanuatu.

Case Study: Adaptation to Climate Change in the Coastal Zone of Vanuatu (VCAP) Project

This is funded by the GEF from 2015 to 2019, aimed to improve resilience in Vanuatu's coastal areas, focusing on sustaining livelihoods, food security, and quality of life. Key strategies included community-driven climate adaptation, integrated coastal management, ecosystem-based approaches, and climate-proof infrastructure. The project also improved climate information access, established community disaster committees, and promoted climate adaptation in policy.

Monitoring and Evaluation (M&E) followed the UNDP framework, incorporating quarterly and annual reviews, periodic site visits, and a mid-term review, which adjusted the project's logframe and indicators. While VCAP strengthened local resilience and information systems, it faced challenges with stakeholder role clarity and limited documentation for knowledge-sharing. This case underlines the need for clear governance, thorough documentation, and adaptive monitoring to effectively support climate resilience initiatives.

Information Related To Averting, Minimizing And Addressing Loss And Damage Associated With Climate Change Impacts

As a small island developing state, Vanuatu faces severe consequences from climate change, despite its negligible contribution of just 0.0016% to global greenhouse gas emissions. The nation has already experienced devastating financial losses, such as over 600 million USD from Cyclone Harold in 2020, which represents more than 60% of its GDP. Furthermore, Vanuatu has incurred billions more in losses from slow onset events, including ocean acidification that threatens coral reefs and rising sea levels that erode coastlines.

Vanuatu's National Climate Change and Disaster Risk Reduction Policy (CCDRR) serves as a crucial framework for addressing these challenges. It outlines concrete actions aimed at averting, minimizing, and addressing loss and damage from various climate hazards. The policy highlights the urgent need to confront irreversible loss and damage caused by extreme

weather events, such as floods and storms, while also emphasizing the importance of tackling non-economic losses, such as cultural heritage and community well-being.

To facilitate the implementation of these activities, Vanuatu has established institutional arrangements that promote coordination and collaboration among stakeholders. This includes ongoing advocacy for the Warsaw International Mechanism and the Santiago Network on Loss and Damage, both of which aim to provide necessary finance, technical support, and capacity building for vulnerable communities.

Moreover, Vanuatu has made a strong call for the establishment of a Loss and Damage Finance Facility under the UNFCCC to address critical financial gaps and mobilize resources effectively. This facility would be instrumental in supporting local initiatives and community resilience against climate-related impacts.

These comprehensive efforts reflect Vanuatu's unwavering commitment to understanding and addressing projected climate-related risks and vulnerabilities. They also underscore the urgent need for enhanced international cooperation and support in addressing loss and damage, ensuring that vulnerable nations like Vanuatu receive the necessary assistance to adapt to the growing threats posed by climate change.

Actions to Address Loss and Damage

Vanuatu is committed to establishing mechanisms that assess and redress loss and damage resulting from climate change impacts. The country has engaged in dialogue around a broader concept of risk reduction, sharing, and transfer through international platforms like the Warsaw International Mechanism for Loss and Damage. This includes discussions on insurance mechanisms, rehabilitation efforts, and compensation strategies.

Vanuatu has outlined several actions aimed at addressing loss and damage, both domestically and internationally:

- Advocacy: Vanuatu is strongly advocating for the operationalization and implementation of actions under the Warsaw International Mechanism for Loss and Damage, ensuring it delivers on its mandate.
- Development of a Loss and Damage Implementation Framework: This includes risk-sharing mechanisms, insurance, and compensation approaches at replacement value to protect communities and assets from climate impacts.
- Assessment of Loss and Damage: The country is conducting detailed assessments of both potential and actual losses, integrating these efforts with ongoing vulnerability assessment processes. These assessments aim to provide a clearer picture of how climate change is impacting various sectors across Vanuatu.
- Sectoral Prioritization and Quantification: Vanuatu is identifying priority sectors—such as food security, culture, and ecosystem services—and working to quantify the specific losses in each sector to guide future responses.
- Mainstreaming into Policies: Loss and damage considerations are being integrated into land and relocation policies, ensuring that climate impacts are accounted for in policies that address population movements and land use.

- Climate-Proofing Development: Vanuatu is also working to provide clarity on the enforcement and mandate for climate-proofing development among government agencies. This includes ensuring that public and major infrastructure projects are designed and built with consideration of current and projected climate risks.
- Building Codes and Regulations: To minimize future loss and damage, Vanuatu is committed to developing and adhering to climate-proofed building codes, environmental impact assessments (EIAs), and development guidelines. This ensures that future infrastructure is resilient to climate change and reduces the risk of damage from extreme weather events.

Through these actions, Vanuatu aims to mitigate the impacts of climate change, while ensuring that loss and damage is systematically addressed through policy, infrastructure development, and international cooperation. The following Loss and Damage Targets have been defined in a decentralised way, by the sectors that are themselves implementing and planning for a resilient future.

Loss and Damage Targets

Table 11: Loss and Damage Targets

Commitment	Sector Policy	Policy Reference	NSDP Reference	SDG Goal	Conditionality (Expressed as %)
Vanuatu commits to contribute to and engage constructively with the UNFCCC, Paris Agreement, Warsaw International Mechanism for Loss and Damage and associated committees, bodies and networks thereof.	CCDRR Policy	7.1.3 and 7.4.4	ENV 3.1	13	90
Vanuatu commits to establish mechanisms to assess and redress loss and damage incurred as a result of climate change.	CCDRR Policy	7.4.4	ENV 3.3	13	100
Vanuatu commits to developing a loss and damage implementation framework, including risk sharing, insurance and compensation approaches at replacement value by 2030.	CCDRR Policy	7.4.4	ENV 3.3	13	90
Vanuatu commits to conducting assessments on potential and actual loss and damage across the country linked with ongoing vulnerability assessment processes, and quantifying losses (e.g. food security, culture, ecosystem services and integrity) particularly	CCDRR Policy	7.4.4	ENV 3.3	13	100

through the Post Disaster Needs Assessment approach.					
Vanuatu commits to ensuring that the design and construction of public and other major infrastructure and development projects consider current and projected risks in order to minimise, avert and address loss and damage, especially by developing and adhering to climate-proofed building codes, environmental impact assessments, regulations and development guidelines.	CCDRR Policy	7.4.4	ENV 3.3	13	90
Vanuatu commits to implement affordable microinsurance and "climate insurance" models to provide additional safety nets to remedy loss of income, damage to housing, infrastructure, crops and other assets from climate disasters.	Disaster Induced Displacement Policy	A10.8	ENV 3.3	13	100
Vanuatu commits to facilitate community-led plans to ensure connections to ancestors and relatives buried in original locations are sustained, and as an important cultural aspect of relocation planning.	Disaster Induced Displacement Policy	A11.2	ENV 3.3	13	100
Vanuatu commits to provide continuing support for life-saving and essential health care to affected populations, including rapid measures to repair and/or rebuild damaged health facilities, and erect temporary health facilities with particular attention on restoring WASH infrastructure.	Health Cluster Strategic Plan	1.1	ENV 3.3	13	90
Vanuatu commits to address the needs of and provide durable solutions for people affected by displacement, including people at-risk of displacement, displaced people, internal migrants, people living in informal settlements, and host communities by enabling ministries to work together to provide protections for people at each stage of the displacement cycle.	Disaster Induced Displacement Policy	Area 10 & Area 3	ENV 3.3	13	100
Vanuatu commits to careful consideration of planned relocation as an option of last resort, ensuring that lessons learned from previous relocation experiences are	Disaster Induced Displacement Policy	Action 3.7	ENV 3.3	13	100

considered, and that movement takes place with dignity and with appropriate safeguards and human rights protections in place.					
Vanuatu commits to expand its calls for finance to address the loss, damage, harm, and injury suffered by its people and nation resulting from climate change, including both quantifiable and intangible impacts, within the multilateral climate regime.	Climate Diplomacy Strategy	1.1	ENV 3.3	13	100
Vanuatu commits to pursue finance and other forms of support for loss, damage, harm, and injury resulting from climate change beyond the UNFCCC, where the multilateral climate processes fail to adequately address the issue.	Climate Diplomacy Strategy	1.2	ENV 3.3	13	100

Cooperation, Good Practices, Experience, and Lessons Learned

Comprehensive Adaptation Efforts: Innovation, Integration, Cooperation, and Knowledge Sharing

Vanuatu has undertaken a comprehensive approach to climate adaptation, encompassing innovative policy solutions, multi-level integration of adaptation actions, regional cooperation, and knowledge sharing with other developing countries.

Policy innovation and pilot projects have played a key role in testing and demonstrating effective adaptation strategies. Projects such as climate-smart agriculture and integrated coastal management have helped communities build resilience against climate events like cyclones and droughts. These pilot initiatives have been supported by policies, such as the National Forest Policy and National Water Policy, that prioritize agroforestry and water conservation.

At different levels of governance, adaptation actions have been integrated into national, provincial, and community planning. The National Adaptation Plan (NAP) and Vanuatu's National Sustainable Development Plan (NSDP) ensure that climate resilience is embedded across key sectors like agriculture, forestry, and water resources, while community-based adaptation has been localized through stakeholder engagement and local action plans.

Vanuatu's participation in regional cooperation platforms like the Pacific Islands Forum Secretariat (PIFS) and the Pacific Resilience Partnership (PRP) has facilitated information sharing and capacity building to address shared climate risks. Partnerships with organizations like the World Bank and UNDP have strengthened institutional capacities to manage climate

risks effectively. These cooperative efforts extend from local-level initiatives to national strategies and regional coordination.

In terms of durability and effectiveness, Vanuatu's adaptation strategies emphasize long-term sustainability. Ongoing monitoring and evaluation help integrate lessons learned into policies, improving the resilience of actions over time. Ecosystem-based measures such as mangrove restoration and sustainable forestry have proven effective in reducing vulnerability to climate impacts.

Vanuatu also contributes to helping other developing countries—particularly Small Island Developing States (SIDS)—identify effective adaptation practices. Through regional platforms like the Pacific Islands Development Forum (PIDF), Vanuatu shares its experiences in managing coastal ecosystems, community-based adaptation, and climate resilience in agriculture, offering valuable lessons for other nations facing similar climate challenges.

Climate Research, Vulnerability Assessments, and Monitoring for Adaptation

Vanuatu has made significant advancements in climate research, vulnerability assessments, and the monitoring of adaptation actions to strengthen resilience against climate change impacts.

The country has enhanced its climate research and early warning systems through partnerships with organizations like the Australian Bureau of Meteorology and CSIRO. These collaborations have improved the ability to forecast tropical cyclones and extreme weather events, supported by the Vanuatu Meteorological and Geo-Hazards Department (VMGD). Additionally, the National Climate Change and Disaster Risk Reduction Monitoring System provides critical, real-time information to inform decision-making and guide communities during extreme climate events.

In terms of vulnerability and adaptation, Vanuatu conducts regular assessments across key sectors such as agriculture, water resources, and coastal zones. These assessments identify the regions and sectors most vulnerable to climate impacts, helping prioritize and guide future adaptation efforts in line with national adaptation priorities.

Vanuatu has also established a monitoring and evaluation (M&E) framework to track the effectiveness of its adaptation initiatives. The National Adaptation Plan (NAP) includes specific indicators, such as the implementation of coastal protection measures and the level of community involvement in adaptation activities. This M&E system ensures continuous improvement of projects by providing data that helps refine adaptation strategies and address gaps.

V. Information on financial, technology development and transfer and capacity-building support needed and received under Articles 9–11 of the Paris Agreement

National circumstances, institutional arrangements and country-driven strategies

Climate Finance Working Group

Climate finance refers to financing channelled by national, regional, and international entities for climate change mitigation and adaptation. The GoV formed a Climate Finance Working Group (the Group), which serves as the consultative arm of the National Advisory Board (NAB) for Climate Change and Disaster Risk Reduction Secretariat. The Group's mission is to make progress on climate finance-related issues in Vanuatu. It is chaired by the strategic manager of the NAB Secretariat and is composed of 15 members, representing the Ministry of Climate Change Adaptation, Prime Minister's Office, Ministry of Finance, Ministry of Agriculture, Ministry of Infrastructure and Public Utilities, the National Trade Development Committee Secretariat, non-governmental organisations, development partners, and private sector partners.

The working group's primary duties are to:

- Provide strategic direction on climate finance-related matters for the Ministry of Climate Change Adaptation and the GoV;
- Move forward the National Implementing Entity Accreditation agenda to provide direct access to multilateral climate funds, such as the GCF and the Adaptation Fund;
- Support the NAB as required to facilitate dialogue with partners on climate finance issues;
- Support the coordination, steering and implementation of climate finance programmes and projects; and,
- Work on and oversee the development of the Climate Finance Roadmap and Action Plan aligned with the NSDP, NCCDRR policy, NDC Roadmap and, the National Adaptation Plan.

In addition, the NAB developed a climate finance roadmap to guide strategic investments in climate finance. It is the coordinating document for projects and cooperation with development partners and includes access, private sector, direct accreditation, stakeholder engagement, public finance management and other issues.

The NAB also developed a climate finance directory to help connect climate funds with those who need them. The directory details known climate finance sources available to individuals, communities, organizations, government bodies and the private sector in Vanuatu. Financing amounts, eligibility requirements and focus areas vary widely depending on the source.

Table 1: Vanuatu's climate finance directory

Small-scale funds	Small funding sources (< Vanuatu vuvu (VUV) 15 million), typically grants, with open applications for individuals, communities and civil society/non-profit organisations.
Large-scale funds	Large funding sources (> VUV 15 million) characterized by diversified financing mechanisms and generally for government, international/ regional organizations, civil society/non-profit organizations and the private sector.
Private sector financing	Financing sources or networks exclusively for private sector stakeholders.
Bilateral funding sources	Bilateral funding provided by national development aid organizations, national development banks, diplomatic missions or foreign consulates.
International agencies	International (including non-governmental, regional and intergovernmental) organizations.

In addition, Vanuatu's CCDRR policy calls for ensuring that adequate funding is made available for climate change and DRR by:

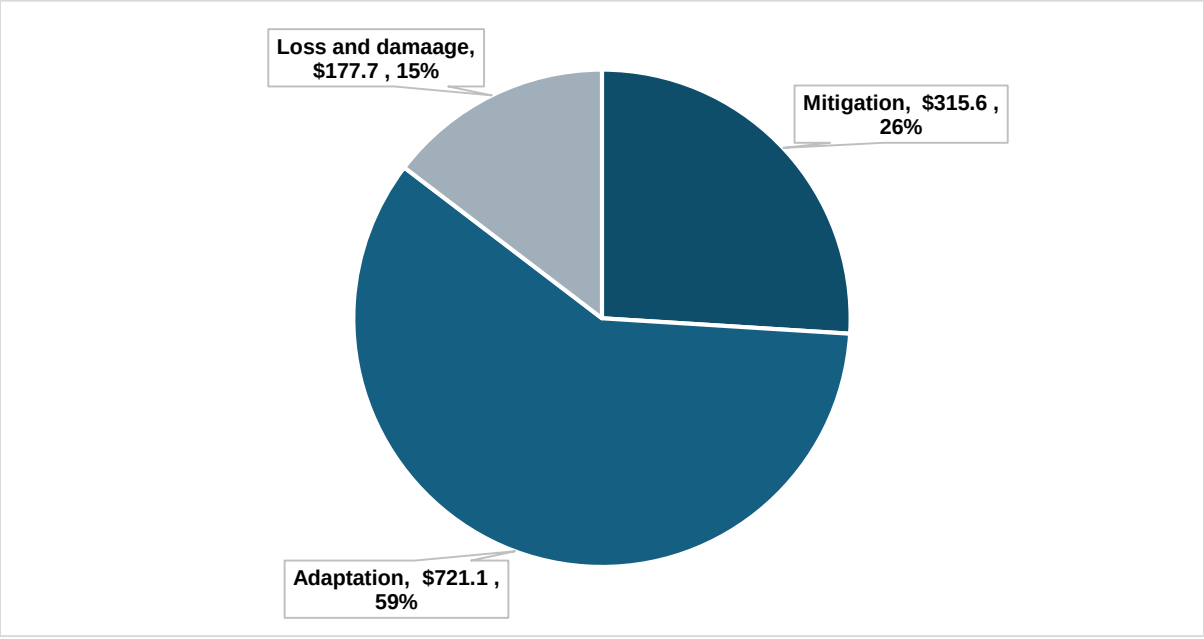
- Allocating CCDRR funding in budgets by development partners, donors, national and provincial governments, area councils, CSOs, and industry sectors;
- Advocating for donor partners to provide funding directly to the national government in line with national government policies and plans;
- Ensuring that external funding is channelled through existing government financial systems;
- Moving forward in establishing a national trust fund for climate change and DRR;
- Exploring opportunities to partner with the private sector for climate change and DRR investment including in renewable energy and waste management;
- Exploring options for a climate change and DRR insurance or risk sharing scheme;
- Ensuring financial accountability mechanisms are in place and operating effectively, including transparent decision-making in funding allocations;
- Facilitating arrangements within Vanuatu and with the international community to ensure timely access to disaster response and recovery funds as needed; and,
- Working to establish and build on robust financial systems including facilitating implementing entity accreditation.

Information on financial support needed by developing country Parties under Article 9 of the Paris Agreement

Nationally, the determination of climate finance needs to meet the Government of Vanuatu's ambitious public policy goals on climate change, including those championed in various national and sectoral policies, which is captured succinctly in the Vanuatu's Revised and Enhanced NDC submitted to the UNFCCC in 2022, including:

- The total approximate cost of achieving the country's updated NDC, including all targets and commitments, is **USD 1.21 billion or VUV 145 billion**.
- **Mitigation targets are estimated to cost USD 315.6 million or VUV 37.8 billion**. It should be noted that the mitigation activities are 100% conditional upon international finance, action, support, technology transfer, and capacity development. This cost estimation does not cover the costs of existing measures, such as measures included in the first NDC of Vanuatu as these measures are already under implementation and already budgeted under NERM. Furthermore, the costs for additional measures are tentative and based on similar international experiences, national circumstances of Vanuatu and other assumptions. A detailed scoping and feasibility study of enhanced NDC measures will be conducted under the NDC implementation roadmap development to determine the exact additional investment requirements.
- **Adaptation targets are estimated to cost USD 721 million or VUV 86 billion**. **Loss and damage targets are estimated to cost USD 177.7 million or VUV 21 billion**. Adaptation and loss and damage activities are a mix of fully or partially conditional, ranging from 70–100% conditionality, depending on each sector and sub-sector. These figures represent the highest priority placed by Vanuatu on resilience, and the extremely high costs associated with failure to adapt, as exemplified by the devastating financial, social, and environmental losses and damages experienced already and expected to increase exponentially as climate change accelerates.

Figure 5.1: Vanuatu's NDC Climate finance needs (USD)



Energy sector

Following the literature review as well as extensive and expanded consultations with national stakeholders, strategic entry points for prioritized investments have become clear for achieving the 100% electricity generation from renewable energy sources. The four prioritized mitigation opportunities presented herein focus solely on increasing renewable energy penetration in the generation mix and one mitigation opportunity focused on improving

generation efficiency as uptake of RE generation sources increase. These have been selected as the most feasible and effective approach to achieving the national target of 100% electricity generation from renewable energy sources by the year 2030.

The combined total investment required is **US$ 13,997,000** to reduce emissions by an estimated 155,066 tonnes CO_2 / Year over the period 2024 to 2030. Funding for these project pipeline investments would stem from potential donors and implementing partners, GoV, concessionaires, and the private sector.

Table 5.1: List of opportunities and their indicative investment needs.

Opportunities	Indicative Investment Needs to 2024 - 2030 (US$)	Cost of Mitigation US$/tCO2	Annual Mitigation 2030 (tCO2/YR)	Total Mitigation 2024 - 2030 (tCO2/YR)
CNO for Electricity Generation for UNELCO Concession Area	$8,125,000	52.64	34,300	154,350
Solar PV and Battery Storage for VUI Mini Grids	$2,500,000	3,488.40	189	717
Develop a CNO price Stabilization Mechanism	$ 50,000	N/A	N/A	N/A
Enhance Policy and Legal Framework to Promote RE	$ 100,000	N/A	N/A	N/A
Solar PV and Battery Storage for VUI Luganville Grid	US$ 3,222,000	N/A	N/A	N/A
Total	**$13,997,000**	**3,541.04**	**34,489**	**155,066**

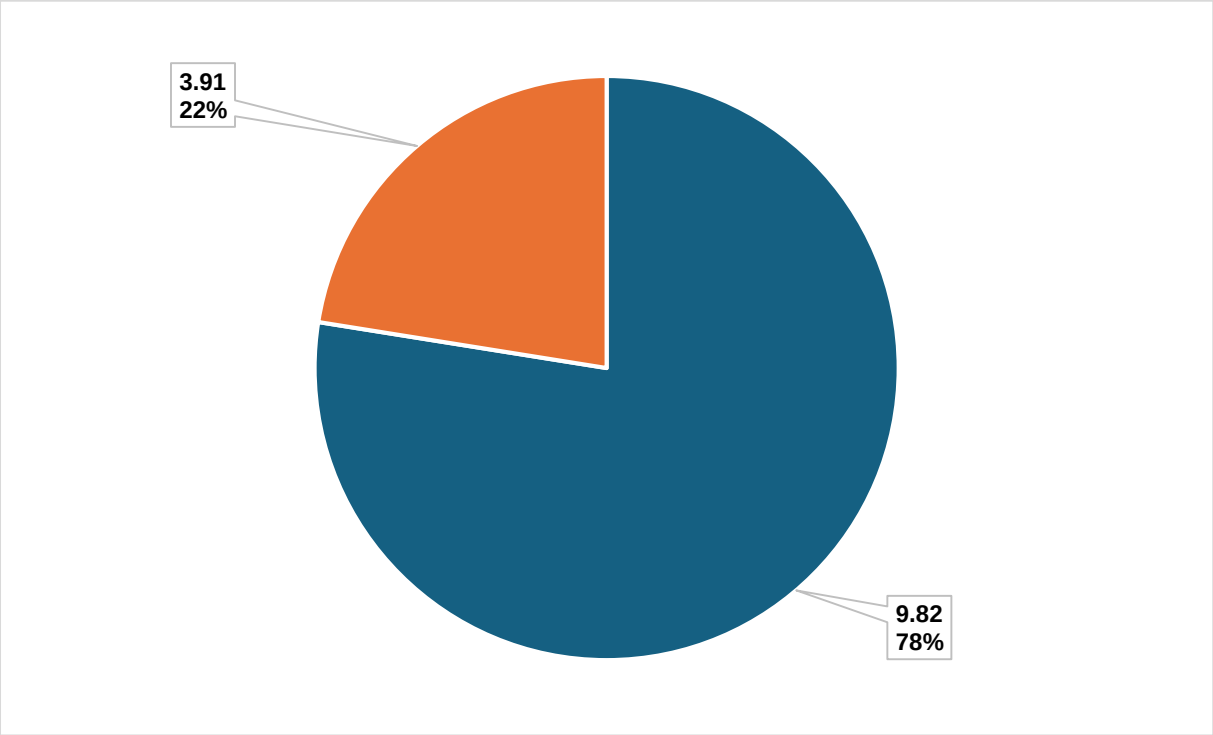
Information on financial support received by developing country Parties under Article 9 of the Paris Agreement

The Government of Vanuatu (GoV) is already taking proactive steps to address climate change in the development planning and some degree of budgeting, both at national and provincial levels. There are several climate change projects being implemented across sectors that are aligned with the country's NDC and GHG emission reduction.

The enhanced NDCs of Vanuatu reflects commitment and efforts in combating climate change and its effects on humans, environment, and ecology. The GoV committed 18 mitigation measures across the relevant GHG emission sectors (Energy, AFOLU and Waste) and key economic sectors. Enhancing energy efficiency and expansion of renewable energy sources are key measures to reduce GHG emissions in the energy sector. Innovative initiatives are underway to leverage cleaner energy sources, particularly Coconut (Copra) Oil based Electricity Generation. Similarly, there are adaptation and cross-cutting activities that also offer climate change mitigation co-benefits. The graph below shows that nearly 52% of the funding

received is directed towards adaptation and disaster risk reduction actions, followed by low carbon mitigation actions focusing mainly on energy sector.

Figure 5.2: Climate funding by type of action (%)



The following table 5.2 highlights funding details of climate change projects in Vanuatu, with key information on the received funding, adaptation, mitigation and cross- cutting actions, and the involved donors and national entities.

Table 5.2: Climate change project type by funding source and funding channels

Climate change project type by funding source and funding channels	
Funding Source	**million USD**
Mitigation	
Bilateral	
Australia	3.77
Austria	0.77
Canada	0.90
Japan	1.23
New Zealand	7.68
Romania	0.06
United Arab Emirates	12.88
USAID	0.20
Subtotal	***27.50***
Multilateral	
Asian Development Bank	7.96
Climate Investment Funds	15.26
Global Environment Facility	8.34
International Development Association	1.37

IUCN, Australia, Vanuatu	0.41
World Bank	4.83
Subtotal	***38.17***
Regional	
European Union and Vanuatu	5.06
Vanuatu	0.12
Subtotal	***5.18***
Total - Mitigation	***70.85***
Adaptation	
Bilateral	
Monaco	0.15
Australia	4.06
DFAT	3.20
Germany	0.16
Italy	0.16
Japan	3.43
Korea	0.87
New Zealand	0.14
USAID	0.50
Subtotal	***12.66***
Multilateral	
French Development Agency (AFD) and the French Global Environment Facility (FFEM) NZ Ministry of Foreign Affairs and Trade, and the Principality of	0.77
Asian Development Bank	18.02
Global Environment Facility	47.66
International Development Association	93.67
Oxfam, GIZ	0.07
Subtotal	***160.19***
Regional	
EU Institutions	7.86
Margaret A. Cargill Foundation	0.38
SPC	4.00
Subtotal	***12.24***
Total- Adaptation	***185.09***
cross-cutting	
Bilateral	
Australia	2.42
CARE UK	0.00
France	0.15
Ireland	0.00
Italy	0.10
Japan	1.28
USAID	2.50
Subtotal	***6.46***
Multilateral	
AUSAID HPA FUNDING / OFDA THRU C/USA	1.00
EU / DFAT	0.01

Global Environment Facility	12.08
International Development Association	6.47
Subtotal	***19.57***
Regional	
PACIFIC ISLANDS FORUM SECRETARIAT	0.06
AusAID funded regional media program; funding coordinated via: Australian Broadcasting Corporation (ABC)	0.09
Multiple agencies Vanuatu	0.06
THE WHITELUM GROUP	0.07
University of Melbourne	0.02
Subtotal	***0.30***
Total- Crosscutting	***26.32***
Grand Total	**282.27**

Information on technology development and transfer support needed by developing country Parties under Article 10 of the Paris Agreement

Vanuatu's enhanced NDC mitigation target is transitioning close to 100% renewable energy in the electricity (energy) sector by 2030. The country has developed an Implementation Roadmap aims at providing a pathway for the NDC implementation of specific climate change mitigation actions to achieve the target defined in Vanuatu's NDC. To support the implementation of the country's NDC, Vanuatu has undertaken a "Technology Needs Assessment (TNA)[14]" specifically at identifying priority technology transfer investments and to assess which environmentally sound technology (EST) are most relevant for meeting the country's climate change adaptation and mitigations targets.

The Ministry of Climate Change Adaptation (MCCA) in collaboration with the United Nations Environment Programme (UNEP) and UNEP DTU Partnership (UDP), and with the Asian Institute of Technology (AIT) funded by GEF, conducted a comprehensive national exercise towards assessing our climate change technology needs. Based on consultation process and judgment, the National Advisory Board (NAB) for the Vanuatu Climate Change Ministry, two major economic sectors were identified and prioritized for **TNA Mitigations: Energy and Waste-to-Energy sectors.** TNA report has also assessed the technology needs for **adaptation in the water and agriculture sectors**.

Mitigation technologies in Energy and waste to energy:

The multi-criteria analytical exercises, including sensitivity analysis confirmed the following:

1) Efficiency Wood Stove is the top mitigation technologies in the energy sector, under the current TNA and followed by Battery Electric Vehicle and Solar Electric Boat respectively under certain conditions.

[14] https://tech-action.unepccc.org/country/vanuatu/

2) Manure Based Biogas digester is the top mitigation technologies in the waste-to-energy sector, under the current TNA and followed by Compact Biogas Digester for Urban Household and Anaerobic Digestion – Biogas Plant respectively under certain conditions.

Technology prioritization for adaptation in agriculture and waste sector:

The results of multi-criteria analysis (MCA), including sensitivity analysis to prioritize and rank technologies for Agriculture are:

- Crop diversification and new varieties
- Agro-forestry
- Farmer Field Schools

While for waster sector are as follows:

- Rainwater harvesting from roof tops
- Water Safety Plans
- Flood Hazard Mapping

Information on technology development and transfer support received by developing country Parties under Article 10 of the Paris Agreement

Recognizing the urgent need for climate mitigation strategies, the government of Vanuatu has actively sought technology transfer assistance from various global partners. This chapter explores the various projects taken by Vanuatu to harness technology for climate mitigation, resilience and sustainable development.

The government of Vanuatu has leveraged international partnerships to gain access to critical technologies. Collaborative efforts with organizations such as the United Nations Development Programme (UNDP), the Global Environment Facility (GEF), and various bilateral agreements have provided a framework for technology transfer.

- **Renewable Energy Technologies**: Vanuatu's commitment to renewable energy has seen the introduction of solar microgrids in rural communities. Through projects such as the UNDP for Barrier Removal for Achieving the National Energy Road Map Targets of Vanuatu (BRANTV) project, Abu Dhabi Future Energy Co. (MASDAR) for Design, supply and install 500 kWp micro grid-connected PV plan and various non-governmental organizations, Solar PV plants, Solar Mirco grids, small hydro power plants technology has been installed in Vanuatu. This empowers local populations and reduces reliance on fossil fuels, increases energy security and reduces carbon emissions.
- **Disaster Risk Management Technologies**: Vanuatu has installed early warning systems and risk assessment tools to better prepare for natural disasters. With assistance from international partners such as UNDP for the Climate Early Warning System (RESPAC) project and Infrastructure and the implementation of Climate Early Warning System (CLEWS) for Vanuatu by EU-GIZ Adapting to Climate Change and Sustainable Energy (ACSE) Programme, advanced monitoring technologies have been deployed to predict severe weather events. This proactive approach not only

saves lives but also protects economic assets reducing loss and damage, allowing communities to recover more swiftly.

Information on capacity-building support needed by developing country Parties under Article 11 of the Paris Agreement

The Government of Vanuatu (GoV) committed 18 mitigation measures across the relevant GHG emission sectors (Energy, AFOLU and Waste) and key economic sectors. The Government is taking initiative to address climate change in the development planning and some degree of budgeting, both at national and provincial levels. However, there are still many barriers and capacity gaps that need to be addressed in order to achieve the set targets.

The Vanuatu NDC Implementation Roadmap outlines Key Enabling Elements, Capacity Building Needs specific to NDC mitigation measures:

1. **Energy Sector NDC Actions that require Capacity building Support**

NDC Action 2: Substituting and/or replacement of fossil fuels with Coconut (Copra) Oil based electricity generation. Policy Initiative: Coconut for Fuel Strategy/Bio-Fuel Policy (initiated by GoV with support from GIZ)

Key Enabling Elements & Capacity Building Needs

- The DoE seeks support in development and implementation of Vanuatu's Coconut for Fuel Strategy,
- The Utilities Regulatory Authority (URA) needs to be supported in terms of tariff setting for renewable energy initiatives in Vanuatu (e.g., Coconut Oil, Distributed Solar Roof-top etc.),
- Mapping of locations and full feasibility studies need to be conducted in order to enhance capacity of existing coconut plantation, establish new coconut plantation and ensure coconut supply chain.
- Financial instruments for climate finance (grants, loans and guarantees) and incremental cost need to be developed and funded to the Independent Power Producers (IPPs) and coconut farmers.
- Financial and technical assistance for increasing coconut yield per hectare by farmers; harvesting and transport logistics are also needed, including price guarantee of gate-payment.
- Assistance in further developing and expanding the PP model between farmers and IPPs, including capacity building and an information dissemination system etc.
- Insurance products need to be developed and funded to cover damage and loss from extreme weather conditions, especially for coconut plantation, solar PV power installation etc.
- Un-skilled, semi-skilled, skilled and highly skilled domestic workforce to develop and maintain coconut plantation and sustained

2. **Transport Sector NDC Actions that require Capacity building Support**

NDC Action 6 – Mileage and emission standards for vehicles. Recommended Policy Initiative as part of this NDC action are: Vehicle import standards, tail gas emission standards, vehicular emission policy; environment/transportation act (amendments).

Key Enabling Elements & Capacity Building Needs

- The Department of Energy (DoE) and Department of Transportation (DoT) seeks support in development and implementation of long term EV and Bio-fuel Policy for Vanuatu.
- Technical and economic feasibility study should be commissioned to address additional power generation needs for the introduction of electric vehicles in Vanuatu. The Utilities Regulatory Authority (URA) needs to be supported in terms of tariff setting for EVs and charging stations.
- Design and implement strategy and policy for fuel, milage and tail gas emission standards, import standards, scrappage policy (including standards, recycling, battery waste) and incentive scheme.
- Design and execute an awareness campaign for owners, operators, associations and other relevant stakeholders (e.g., road transport and shipping companies, associations) for mitigation in transport.
- Financial instruments for climate finance and non-financial incentives (parking facility, green licence plates etc.) towards bearing incremental cost to the Independent Power Producers (IPPs) and EV owners.

3. NDC Action of other Sub-Sectors under the Energy Sector – Commercial, Institutional and Residential

NDC Action 7 –Biogas Plants for Commercial and Residential Use (1000 systems).
Recommended Policy Initiative: Biogas/clean cooking policy (amendments).

Key Enabling Elements & Capacity Building Assistance Needs

- The Department of Energy seeks support in development and implementation of Biogas/clean cooking Policy for Vanuatu, capacity building and communication strategy.
- Commissioning of a detailed study on municipal solid waste composition, and the optimisation of solid waste collection and sorting for the urban and rural area

NDC Action 8 – Energy efficiency in the commercial and residential sectors

NDC Measure 8.1 – 5% increase/improvement in energy efficiency in the commercial and residential sectors

NDC Measure 8.2 – 10 Energy Efficient Buildings (Green Buildings)

Key Enabling Elements & Capacity Building Needs

- The DoE seeks support in development and implementation of energy efficiency and green building policy for Vanuatu, capacity building and communication strategy.
- Detailed assessment study on key appliances for which updated and new energy performance standards are required. Followed by formalising and legislating the energy saving standards.
- Review and assess existing national building codes and incorporate disaster risk reduction (DRR) and green/sustainable building features and include key performance indicators. Training and capacity building, awareness programme for key stakeholders.

4. **Agriculture, Forestry and Other Land Use (AFOLU) NDC Actions that require Capacity building Support**

NDC Action 12- (Circular Economy Strategy)- International Collaboration to Improve Livestock Efficiency

Key Enabling Elements & Capacity Building Needs

The Ministry of Agriculture, Livestock, Forestry, Fisheries and Biosecurity (MALFFB) seeks support in developing capacity and know-how for farmers on sustainable livestock farming techniques and scientific pasture management.

5. **Waste and Waste Water Sector NDC Actions that require Capacity building Support**

NDC Action 16 (Circular Economy Strategy) - National Plastics Strategy Recommended Policy Initiative: National Plastic Waste Policy

Key Enabling Elements & Capacity Building Needs

- Commission a detailed study on solid waste composition, and the optimisation of solid waste collection and sorting for the Port Vila area (especially a resource survey (GIS), processing techniques, and logistics planning).

NDC Action 17 – Waste Water Management System in Vanuatu

NDC Measure 17.1-Centralised Waste water collection and treatment system in municipal area including awareness and capacity building

NDC Measure 17.2- Improvements to Public and Communal Toilet Facilities including Bio- Toilets

Key Enabling Elements & Capacity Building Needs

- Commission a detailed study on waste water collection and treatment, installation of STPs in all municipal area in Vanuatu.

Information on capacity-building support received by developing country Parties under Article 11 of the Paris Agreement

Initiative for climate action transparency (ICAT) is supporting Vanuatu in building national capacity for compiling GHG inventories, building a foundation for the NDC targets and tracking, and creating the evidence platform for the climate policies through improving Vanuatu's national inventory system for collecting GHG-related data and estimating GHG emissions from the categories prioritized by Vanuatu.

ICAT is assisting Vanuatu in building national capacity in Vanuatu in GHG and sustainable development (SD) policy assessment (the agriculture sector) using ICAT tools.

The project will discuss the potential for extending the sectoral coverage and fine-tuning the national targets by using the national data as the evidence base. The project will propose the potential indicators for the NDC tracking in light of the potentially extended targets and identify

the required data sets and the applicable institutional arrangements to enable the relevant data. The project started in March 2023.

The project scope of work includes:

- Improve the capacity of Vanuatu to estimate emissions from the prioritized key categories using the best available data and information in the following sectors:
  - Energy: calculating reference approach from the National Energy Balance, transport emissions
  - Agriculture: livestock emissions (enteric fermentation and manure management)
  - Waste: solid waste disposal and domestic wastewater
  - IPPU: consumption of fluorinated gasses from refrigeration and air conditioning
- Develop a basic understanding of relevant ICAT tools for GHG and sustainable development policy impacts in agriculture to use such tools for other policies in the future.
- Perform an impact assessment of up to two agriculture policies prioritized by Vanuatu.
- Design indicators to track the impacts of the prioritized agricultural policies, and identify the required data sets and the relevant institutional arrangements to enable the relevant data collection and processing in the future.
- Investigate the ways the agriculture sector can be included in the scope of Vanuatu's enhanced NDC and provide relevant recommendations to Vanuatu's Government.

Capacity building training for the MoCC on Developing Funding Proposals to the Green Climate Fund

The Global Green Growth Institute (GGGI) has delivered a series of capacity building trainings for the Government of Vanuatu on accreditation to the Green Climate Fund (GCF). The targeted audience of the capacity building training were officials from the Ministry of Climate Change (MoCC), with key staff from the Ministry of Finance and Economic Management (MFEM) and Prime Minister's Office (PMO).

GGGI delivered this capacity building trainings as part of its role as a Delivery Partner under the ongoing GCF Readiness and Preparatory Support Programme project, 'Enhancing Vanuatu's Ability to Seek Accreditation and Direct Access to the GCF.

Information on support needed and received by developing country Parties for the implementation of Article 13 of the Paris Agreement and transparency-related activities, including for transparency-related capacity-building

Capacity Building Initiative for Transparency (CBIT) Project

The Vanuatu CBIT project was approved for funding by the Global Environment Facility in July 2022 under GEF-7. The intended purpose is to strengthen capacity in the energy, waste, agriculture, forestry, and other land-use sectors for enhanced transparency in the implementation and monitoring of Vanuatu's Nationally Determined Contribution.

The CBIT project aims to develop Vanuatu's institutional and human capacities for complying with Enhanced Transparency Framework (ETF) reporting requirements of the Paris

Agreement, and implementation and monitoring of Vanuatu's Nationally Determined Contribution focusing on energy, agriculture, forestry, and other land-use sectors.

The project will be implemented by the FAO and executed by the Ministry of Climate Change and the Ministry of Agriculture (MALFFB). This is a three-year project with a completion date of May 2025.

The project has two components and ten outputs. The first component is to strengthen institutional arrangements, and the outputs include sectoral transparency guidelines and protocols for enhanced NDC climate change mitigation, adaptation, and addressing L&D for observed and potential climate change impacts (e.g. extreme weather events and slow onset events). The second component includes provision of an online platform, tools, and training for a robust MRV system focusing on energy, agriculture, forestry, and other land-use sectors.

VI. Information related to Averting, Minimizing And Addressing Loss And Damage Associated With Climate Change Impacts under Article 8 of the Paris Agreement

Vanuatu's Historical Engagement in and Ambition to address Loss and Damage

Vanuatu has been a leader in Loss & Damage issues from the very outset of the multilateral climate change processes. Vanuatu, as founding chair of the Alliance of Small Island States (AOSIS), put forward the concept of an International Insurance Pool[15] to compensate low-lying islands for the loss and damage associated with sea level rise. Due to extreme pushback from rich developed countries, this provision was not included in the United National Framework Convention on Climate Change (UNFCCC) when it was adopted in 1992.

Since that time, Vanuatu has continued to lead on loss and damage in the UNFCCC with a focus on engaging with the Warsaw International Mechanism on Loss & Damage, designing and operationalising the Fund for responding to Loss & Damage, enhancing wider loss and damage funding arrangements, expanding international cooperation, and refining policy frameworks aligned with the Paris Agreement to address the economic and non-economic impacts of climate change including from sudden-onset events, like cyclones and floods, and slow-onset processes, such as sea level rise and ocean acidification.

Notably, when Vanuatu submitted its instrument of ratification to the Paris Agreement on 21 September 2016, in the context of Loss & Damage and in consideration of its views on the need for reparations and compensation, the ratification compendium declaration reads, in part:

> *"…the Government of the Republic of Vanuatu declares its understanding that ratification of the Paris Agreement shall in no way constitute a renunciation of any rights under any other laws, including international law, and the communication depositing the Republic's instrument of ratification shall include a declaration to this effect for international record."*

In May 2022 Vanuatu's Parliament unanimously endorsed a Declaration of Climate Emergency[16], which contains critical Loss & Damage policy context, including which:

[15] http://unfccc.int/resource/docs/a/wg2crp08.pdf
[16] https://www.vanuatuicj.com/emergency

(h) Observes the irrevocable loss and damage to our economy, society and environment that has been caused by global heating of more than 1 degree Celsius, demonstrating that the Earth is already too hot for safety, as attested by intensifying extreme weather like cyclones, floods and droughts as well as slow onset events like ocean acidification and sea level rise.

(j) Observes that the adverse effects of climate change falls most heavily on those segments of the population that are already in vulnerable situations owing to factors such as geography, poverty, gender, age, indigenousness, sexual orientation, birth, people with special needs or other status.

(l) Recognizes that ambitious and transformative climate action is urgently required across all sectors, by all stakeholders and at all levels, to prevent catastrophic climate change impacts, losses and damages.

(q) Decides that the Government of the Republic of Vanuatu will work tirelessly towards building resilience and the restoration of an optimal safe global climate by

a. Responding to the climate emergency in ways that emphasize equity, self-determination, culture, tradition, democracy, and the protection of fundamental human rights.
b. Submitting a new and enhanced Nationally Determined Contribution which demonstrates global highest levels of ambition with targets on Vanuatu's sector priorities in adaptation and loss & damage.
c. Pursuing all suitable avenues under international and domestic law to prevent harm resulting from climate change, including protecting the rights of present and future generations, including, by seeking an Advisory Opinion from the International Court of Justice on the obligations of States under international law to protect the rights of present and future generations against the adverse effects of climate change.
d. Further engage the public, through civil society agencies and Networks, in climate-emergency and climate justice related deliberations.

In December 2022, Vanuatu joined with the Commission of Small Island States on Climate Change and International Law (COSIS) to make a Request to the International Tribunal for the Law of the Sea (ITLOS)[17] on key legal questions directly related to climate-related loss and damage to our oceans, namely:

What are the specific obligations of State Parties to the United Nations Convention on the Law of the Sea (UNCLOS) to
(a) to prevent, reduce and control pollution of the marine environment in relation to the deleterious effects that result or are likely to result from climate change, including through ocean warm in g and sea level rise, and ocean acidification, which are caused by anthropogenic greenhouse gas emissions into the atmosphere? and
(b) to protect and preserve the marine environment in relation to climate change impacts, including ocean warming and sea level rise, and ocean acidification?

In May of 2024, the Tribunal made its historic ruling which identified greenhouse gasses as a marine pollutant under the convention, and advises that States indeed do have specific legal obligations outside of the Paris Agreement and UNFCCC to prevent harm (loss and

[17] https://www.itlos.org/en/main/cases/list-of-cases/request-for-an-advisory-opinion-submitted-by-the-commission-of-small-island-states-on-climate-change-and-international-law-request-for-advisory-opinion-submitted-to-the-tribunal/

damage) to the oceans. This ruling sets the stage for specific litigation against States that do not take adequate and science-based measures to control ocean-polluting emissions.

Vanuatu led an historic initiative at the United Nations General Assembly in 2023 to request for an Advisory Opinion to the UN's International Court of Justice[18] seeking clarity, under International Law on:
1) What are the obligations of States under international law to ensure the protection of the climate system and other parts of the environment from anthropogenic emissions of greenhouse gases for States and for present and future generations;
(2) What are the legal consequences under these obligations for States where they, by their acts and omissions, have caused significant harm to the climate system and other parts of the environment, with respect to:
(a) States, including, in particular, small island developing States, which due to their geographical circumstances and level of development, are injured or specially affected by or are particularly vulnerable to the adverse effects of climate change?
(b) Peoples and individuals of the present and future generations affected by the adverse effects of climate change?"

Vanuatu's climate diplomatic teams lobbied more than 133 nations to co-sponsor the Resolution at the UNGA[19] that sent the question to the court. These ICJ proceedings are currently underway[20] with States making and responding to others' submissions. An Advisory Opinion can be expected in early 2025.

To prevent and disincentivise environmental loss and damage from climate change, in 2024 Vanuatu (along with Fiji and Samoa) proposed to the Assembly of States Parties to the Rome Statute of the International Criminal Court (ICC) that ecocide be formally classified as an international crime[21], defined as **"***unlawful or wanton acts committed with knowledge that there is a substantial likelihood of severe and either widespread or long-term damage to the environment being caused by those acts."*

National Understanding of Loss and Damage

Under the United Nations Framework Convention on Climate Change (UNFCCC), Loss and Damage (L&D) generally refers to the adverse effects of climate change that cannot be avoided through mitigation or adaptation.

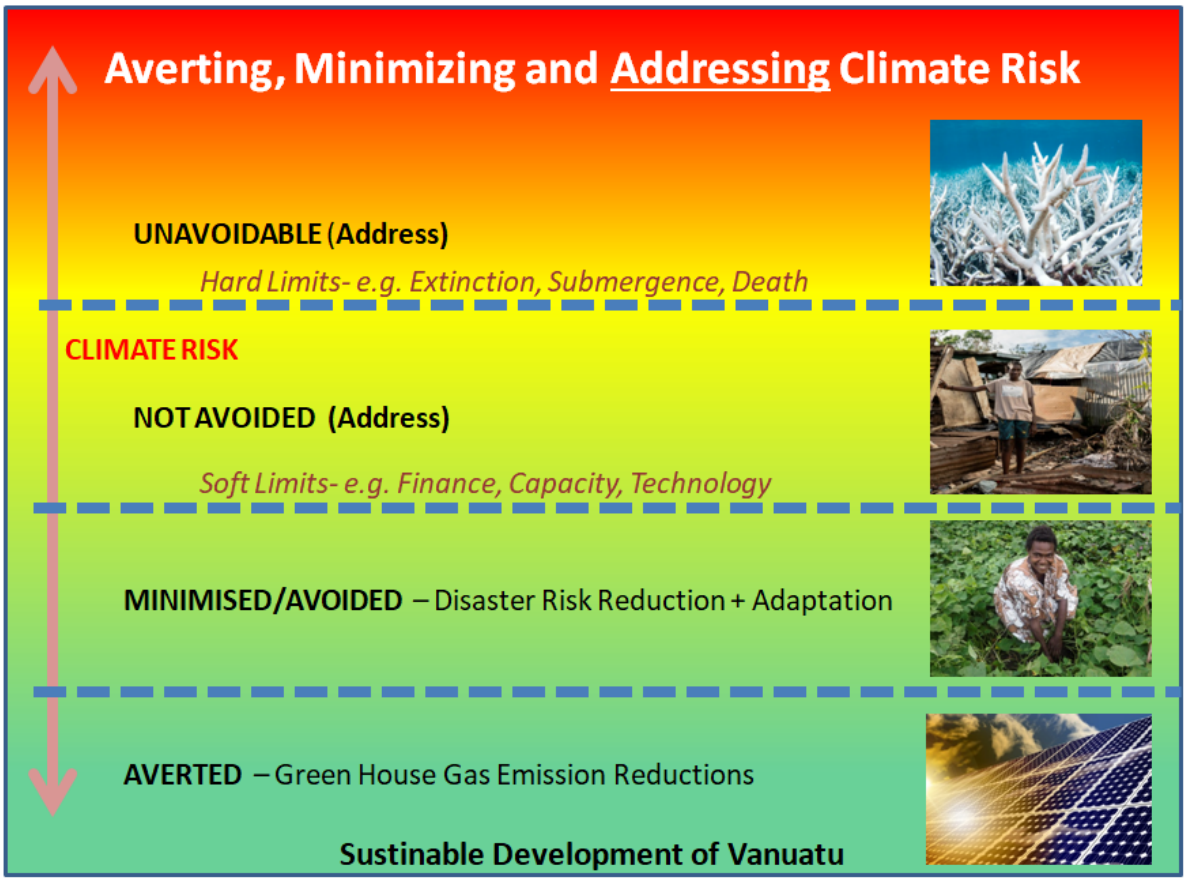
Vanuatu has experienced existential loss and damage firsthand. As a result of these experiences, Vanuatu is now working on a localised definition of Loss and Damage which builds on the understanding in Vanuatu's National Policy on Climate Change and Disaster-Induced Displacement[22]: "the loss and damage associated with the adverse effects of climate change, including impacts related to extreme weather events and slow onset events. Damage is therefore the negative impacts that can be repaired or restored (such as windstorm damage to the roof of a building, or damage to a coastal mangrove forest from coastal surges which affect villages). While, loss is the negative impacts that cannot be repaired or restored (such as loss of geologic freshwater sources related to glacial melt

[18] www.VanuatuICJ.com
[19] https://documents.un.org/doc/undoc/ltd/n23/094/52/pdf/n2309452.pdf?token=MYe2stN3ptvJrPYEGB&fe=true
[20] https://www.icj-cij.org/case/187
[21] https://www.theguardian.com/law/article/2024/sep/09/pacific-islands-ecocide-crime-icc-proposal
[22] https://www.iom.int/sites/g/files/tmzbdl486/files/press_release/file/iom-vanuatu-policy-climate-change-disaster-induced-displacement-2018.pdf

or desertification, or loss of culture or heritage associated with potential population redistribution away from areas that become less habitable due to climate change)".

This understanding is now being expanded to reflect the common perspective of ni-Vanuatu people of the inherent inequality that climate suffering and harm is being caused by the acts and omissions of developed countries in regard to increasing greenhouse gas emissions from expanding fossil fuel production and use.

The local definitional work also aims to situate loss and damage in the larger landscape of mitigation, disaster risk reduction, humanitarian action, disaster response and other related parts of the climate action spectrum.



The people of Vanuatu are experiencing increasingly severe impacts from climate change, driven by increases in greenhouse gas (GHG) concentrations which are unequivocally **caused by human activities associated with fossil fuels** and industry. **Vanuatu** and other Pacific Small Island Developing States are **not responsible for climate change**, and have contributed less than *0.0016*% and 0.02% respectively to global historical greenhouse gas emissions.

Climate impacts can be constrained by the level of preventive action, both through **reducing greenhouse gas emissions (avert risk)** and by **adaptation and disaster risk reduction measures (minimise risk)**.

Thus Vanuatu's climate vulnerability stems from **insufficient global mitigation efforts**, its direct exposure to a range of climate and non-climate risks, as well as **inadequate levels of action and support for adaptation** provided to Vanuatu as an unfulfilled

obligation of developed countries under the UN Framework Convention on Climate Change[23], and reaffirmed in the Paris Agreement[24]. Taken together, Vanuatu's climate vulnerability is one of the highest in the world.

These already catastrophic **impacts are expected to worsen exponentially** when Global warming exceeds the 1.5°C temperature threshold set by the Paris Agreement. Further warming increases the likelihood and expands the impacts of **abrupt and/or irreversible changes in the climate system**, making it particularly challenging to predict the impacts triggered when **tipping points** are reached.

Comprehensive Risk Management (CRM) is an approach for managing the risk of loss and damage and addressing actual loss and damage. There are a range of actions being employed currently within Vanuatu's territory to reduce growing climate risks. The comprehensive risk management landscape in Vanuatu includes a diverse **climate adaptation and disaster risk reduction sector**, which works to reduce vulnerability to climate impacts by minimising risks, building resilience and supporting communities and ecosystems adjust to changing climate conditions, a vibrant **humanitarian sector** which focuses on protecting lives, alleviating suffering, and providing immediate relief after climate disasters, as well as a **recovery sector**, which focuses on helping communities rebuild, restore and return to safe, sustainable conditions, including through medium and long-term programs.

However it is no longer possible to prevent or minimise all climate risks as historical greenhouse gas emissions and investments into fossil fuel industries have already locked us to a certain level of climate impacts. Moreover, not all climate change impacts can be successfully adapted to, whether because of financial, technical, or physical constraints. The actions undertaken are far too little and long too late, and as a consequence climate losses and damage occur.

Climate losses and damages refer to the negative impacts of climate change, including those that are permanent, irreversible, or difficult to address due to inadequate global action on mitigation and adaptation pathways, or due to soft and hard limits to adaptation and risk reduction.

The harms being suffered by Vanuatu's people, ecosystems and economies include, often irreversible and increasingly permanent impacts on **goods and services with market or economic value (economic loss sand damage)** as well as **assets which may be less tangible, quantifiable or not linked to economic value (non-economic loss and damage)** such as loss of human lives, loss of cultural heritage, health and psychosocial impacts, biodiversity and ecosystem services decline.

Moreover, climate hazards manifest at different timescales, and the speed at which impacts emerge is variable, including those which **occur over hours or days (extreme events)** such as tropical cyclones, extreme rainfall, meteorological drought and **those which manifest over months, years of decades (slow onset events)** such as sea level rise, ocean acidification and groundwater salinification.

Damage may be further understood as impacts that can be repaired or restored (such as windstorm damage to the roof of a building, or damage to a coastal mangrove forest from

[23] Article 4 (3) Developed country Parties shall provide such financial resources, including for the transfer of technology, needed by the developing country Parties to meet the agreed full incremental costs of implementing their commitments under the Convention, taking into the need for adequacy and predictability in the flow of funds.

[24] Article 9 (1) Developed country Parties shall provide financial resources to assist developing country Parties with respect to both mitigation and adaptation in continuation of their existing obligations under the Convention

coastal surges which affect villages). While, **Loss may be understood as impacts that cannot be repaired or restored** (such as loss of geologic freshwater sources related to glacial melt or desertification, or loss of culture or heritage associated with potential population redistribution away from areas that become less habitable due to climate change).

Because the **impacts of global warming manifest locally, loss and damage is realised at the finest resolutions**, but can be aggregated for analysis at provincial, national and even regional levels. Actions to address losses and damages can also be undertaken at all levels, while maintaining the **principle of subsidiarity which holds that loss and damage decision-making authority should be placed where climate impacts and responsibility for outcomes will occur**.

Climate loss and damage threatens indigenous traditional knowledge by disrupting ecosystems, altering ancestral lands, and undermining cultural practices that rely on specific environmental conditions, making it essential to address the loss of language, culture, customary practise and knowledge across solutions spaces. Indigenous people and communities have both rights and agency to address climate impacts in a self-determined way, including through the use of Traditional knowledge.

The more severe the climate impacts, the less likely risk minimising efforts will succeed, and the more risk will be retained, leading to more loss and damage. **Limits to adaptation are already being breached on a daily basis in Vanuatu**, with communities wasting time and energy on resilience strategies that cannot withstand the climate impacts occurring now.

New and additional finance for loss and damage is crucial to address the growing impacts of climate change, as sectors and households face escalating costs from extreme events and slow-onset changes. **Innovative and accessible financial mechanisms are required** to allow direct access to vulnerable groups, and sources from diverse funding arrangements including budget allocations, concessional finance, insurance, multilateral climate funds, bilateral support, and innovative use of taxes and levies.

Due to the historical responsibility of polluting countries and companies, the significant harm to the climate system and other parts of the environment, and the injury suffered by particularly vulnerable people and specially affected present and future generations, **there exists a right to remedy including access to justice, restitution, compensation, rehabilitation, satisfaction, and guarantees of non-repetition**. Right to remedy ensures that affected individuals or communities can seek redress through fair and accessible legal processes, obtain compensation or restitution for damages, and receive support to restore their well-being and dignity.

Climate Loss & Damage as a consequence of cascading, compounding and intensifying climate risks

As climate change intensifies, Vanuatu's riskscape is transforming. Climate risks compound and cascade to amplify the adverse impacts experienced by Vanuatu's small island communities, including further diminishing social and economic resilience. For

example, in 2023 Vanuatu suffered twin cyclones and an earthquake in just 48 hours[25], demonstrating that seismic and climate risks are converging to augment loss and damage experienced locally. A 2022 analysis[26] finds that as warming continues, countries like Vanuatu will be exposed to higher risk of tropical cyclones, both in terms of event intensification, as well as cascading multi-hazard scenarios.

Anexample of cascading and compounding hazards was documented in the remote Western part of Vanuatu's largest island: Espiritu Santo in 2022, where extreme and prolonged rainfall interacted with a series of earthquakes to cause two catastrophic landslides and causing loss and damage to cultural sites and the full relocation of an indigenous community[27],[28].

Intersecting hazards have cascading and compounding impacts upon areas already suffering the adverse impacts of climate change, including both slow onset and extreme weather events. In another example, many of the low lying settlements in Port Vila, which were in the process of rebuilding after being washed out in the major La Nina flooding of May 2022[29], suffered a secondary wash out event during the March cyclones. Some of the areas hit were still recovering from the impacts of Cyclone Pam (a category 5 cyclone which had devastating economic and non-economic impact[30]), and many other areas were already facing the damaging impacts of rising sea levels and ocean acidification.

The costs of these compounding impacts have never been fully calculated (see next section for estimates), as slow onset events rarely trigger humanitarian or insurance responses, with the burden shouldered entirely by island populations. For this reason, the government recently launched a Statistical development plan for Vanuatu disaster-related statistics 2024–2028 to coordinate, collate, produce, and disseminate quality and timely disaster-related statistical information for managing and reporting on the risk, occurrence, and impact of major disasters in Vanuatu.[31]

More than a decade ago in 2011, the Global Facility for Disaster Reduction and Recovery GFDRR estimated that Vanuatu incurs an average of $48 million per year in losses due to natural disasters like tropical cyclones, a figure that is equivalent to 6.6 percent of national GDP[32]. More recent estimates[33] put annualized economic losses, which include losses from intensive and extensive risk, indirect losses and slow-onset disasters is approximately 166.96 million USD per year, which represents at least 21% of GDP. Pacific SIDS Average Annual Losses (AAL) per capita are at least three times higher than the average for South-East Asia, South and South-West Asia, and North and Central Asia.

Recent climate extreme events however are dwarfing these estimates, as single extreme events are now regularly costing more than 60% of Gross Domestic Product GDP, which in 2022 was 1.06 billion USD[34]. Category 5 cyclone Pam, which hit the nation in 2015, caused an estimated US$449.4 million of damages. The PDNA[35] suggests that US$270.9

[25] https://www.bbc.com/news/world-asia-64832870
[26] https://www.unescap.org/kp/2022/pathways-adaptation-and-resilience-pacific-sids-subregional-report
[27] https://www.iied.org/21891iied
[28] https://www.youtube.com/watch?v=nWID37WOjHw
[29] https://media.greenpeace.org/C.aspx?VP3=SearchResult_VPage&STID=27MDHUFSCX2C
[30] https://www.britannica.com/topic/Cyclone-Pam
[31] https://vbos.gov.vu/sites/default/files/NSDS%3B%20Disaster%20Related%20Statistics%202024-2028.pdf
[32] https://www.gfdrr.org/en/publication/country-risk-profile-vanuatu
[33] https://www.unescap.org/sites/default/d8files/IDD-APDR-Subreport-Pacific-SIDS.pdf
[34] https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?locations=VU
[35] https://dsppac.gov.vu/images/docs/PDNA/PDNA_Cyclone_Pam.pdf

million was attributable to damage, and VUS$178.5 million was attributable to loss. This is equivalent to 64.1% of Vanuatu's GDP, giving an indication of the scale of impact. Because of data limitations, however, it is likely that these figures underestimate the total impact. The sectors that sustained the highest level of damage were the housing sector, which accounts for 32% of the total damage costs, followed by the tourism sector (accounting for 20% of all damage), the education sector (accounting for 13% of all damage), and the transport sector (accounting for 10% of total damage). In contrast, the largest level of economic loss was to the agriculture and tourism sectors, estimated at 33% and 26% of the total losses respectively. In addition, the environmental sector suffered significant losses to ecosystem services, although these losses are not accounted within the impacts to GDP. The subsequent El Nino drought in 2016 continued to wreak havoc on the agricultural backbone of the economy, threatening the food security of the entire population.

Category 5 Cyclone Harold devastated Vanuatu in 2020, in the midst of the COVID19 crisis, completely overwhelming the capacity of locally based stakeholders to adequately respond. In the combined PDNA[36] for the two disasters, the compound nature of TC Harold and COVID-19 intensified the scale, and broadened the scope, of the human, social, economic and environmental impacts. International border restrictions had negative repercussions on the economic activity and hindered the humanitarian response. The Vanuatu TC Harold and COVID-19 Post Disaster Needs Assessment estimates that the monetary value of the disaster effects was US$617 million, corresponding to approximately 61% of GDP in 2020.

In order to capture the true loss and damage from this catastrophic cyclone, including the non-economic losses to biodiversity and ecosystem services, the Vanuatu Government innovated through a non-economic valuation exercise[37]. On ground surveys found that entire ecosystems and critical habitat were impacted by TC Harold, for example 100% of water systems on 4 islands increasing the incidence of water borne illness and loss of 90% of large trees that supply bats and birds with food and shelter. Quantification of ecosystem services loss and damage estimated environmental effects worth, in monetary terms, over US$12 billion, which dwarfed the US$617 million which was published in the final PDNA Report.

The twin Category 4 cyclones of 2023, TC Kevin and TC Judy, which hit Vanuatu within 48 hours of each other, affected more than 80 percent of the population. The PDNA[38] found the total effects to be US$433 million, in which Damage amounted to 68.9% or US$298.6 million and Loss accounted for 31.1% or US$134.5 million. As a result of the twin cyclones, Vanuatu's GDP growth forecast for 2023 was officially revised down from 3.6% to 3.0%. Importantly, the overall Government and Donor financing ran a fiscal deficit of US$ 50.9 million, which was financed entirely by both domestic bonds and external loans, increasing Vanuatu's debt burden and resulting in shifts from finance from critical services like health and education to debt service.

Later in 2023, severe Cyclone Lola made landfall in Vanuatu's northern islands, affecting 46,000 households, representing over 180,000 people, with destructive winds, intense rainfall and flooding. An estimated 75 per cent of buildings and houses were destroyed in the impacted areas. The devastation and trauma caused by TC Lola has further compounded by the recent economic, social and environmental impacts of TC Judy &

[36] https://dsppac.gov.vu/images/roc/pmo001-post-disaster-needs-assessment-volume-a_hr-single-pages__p41044.pdf
[37] PDNA Environmental Cross Sectoral Report Final-1.pdf - Google Drive
[38] https://dsppac.gov.vu/images/roc/roc_23/pdna/tc-judy-and-tc-kevin-pdna.pdf

Kevin, TC Harold, high La Nina rainfall, the cyber-attack on Government servers and all on the back of the COVID-19 pandemic. Together, these events threatened the lives and livelihoods of all people across the archipelago, and undermined the achievement of the aspirations set in Vanuatu 2030 – The People's Plan, our National Sustainable Development Plan. In total, the total estimated recovery needs is just over US$370 million, which represents ~52% of Vanuatu's GDP[39].

In addition to the dramatic losses and damages quantified after extreme events like cyclones as outlined above, there have been unquantified impacts from other events, including slow onset events including sea level rise, ocean acidification, sea surface temperature, atmospheric temperature and changes to seasonal rainfall, including as influenced by the El Niño–Southern Oscillation (ENSO).

During El Niño phases, Vanuatu experiences lower than normal rainfall, including often meteorological and agricultural drought, which has direct and often severe impacts on food security, water security, health and sanitation and ecosystem integrity. Similarly, La Niña phases bring unseasonal rainfall, as well as devastating flooding events which have regularly paralysed the international airport, closed essential services and businesses for days on end, destroyed local roads and other infrastructure.

- **2015–2016**: A strong El Niño event occurred, significantly impacting agricultural outputs and threatening food security for most ni-Vanuatu families.
- **2017–2018**: A weak La Niña developed, causing damage to roads, airstrips, and leading to landslides
- **2018–2019**: A weak El Niño event was observed, leading to a prolonged drought across Vanuatu's southern islands.
- **2020–2021**: A moderate La Niña event took place, leading to increased rainfall which caused rotting and spoilage of fresh produce and disease incidence in humans and livestock
- **2021–2022**: A second consecutive La Niña event occurred, continuing to exacerbate the rain-induced loss and damage, including landslides which covered villages and prompted full relocation
- **2023–2024**: A strong El Niño event developed, causing drought conditions across all islands, and leading to crop and livestock death, coral bleaching and closure of schools and clinics due to lack of water

Non-Economic Loss & Damage and Slow Onset Events

The financial analyses of the PDNAs highlighted above do not capture the intangible impacts of climate change on the people and ecosystems of Vanuatu, which profoundly, and often irreversibly, affect its communities and cultural heritage. The frequent and intense cyclones, rising sea levels, and increasing temperatures have led to the loss of invaluable cultural sites, traditional knowledge, and community cohesion. Entire villages have been displaced, disrupting social networks and eroding the communal way of life that is central to Vanuatu's identity. The psychological toll of recurrent disasters has resulted in widespread trauma and a sense of helplessness, particularly among women and young people. Additionally, the degradation of ecosystems, such as coral reefs, tropical forests and mangroves, which are integral to the cultural, linguistic and spiritual practices of the Ni-Vanuatu people, further exacerbates the non-economic impacts. These losses are immeasurable in monetary terms but are deeply felt, highlighting the urgent need for

[39] https://nab.vu/sites/default/files/documents/TC%20Lola%20Recovery%20Plan.pdf

comprehensive and culturally sensitive strategies to address and mitigate non-economic loss and damage in Vanuatu.

Recent studies in Vanuatu published in Nature Climate Change[40] demonstrate that climate change is impinging on people's human rights. Climate impacts ranging from slow-onset changes, such as sea level rise, saltwater, intrusion, longer dry periods and increasing temperatures, to extreme weather events, such as more intense cyclones, heavy downpours and flooding. The extent to which climate change impacts have affected everyday lives over the last year. When compared to key human rights declarations and covenants, participants observations of the climate effects on their lives demonstrated that fundamental human rights have already been undermined. The most severe impacts are on Ni-Vanuatu's rights to a healthy environment and ability to own, use, develop and control lands, followed closely by high impacts on rights to property and communal assets, standard of living, and family and social cohesion.

The impingements of climate change on ni-Vanuatu people's human rights are having cascading implications on numerous other interconnected human rights and can transcend across generations. Examples of such implications experienced in Vanuatu include climate-induced losses of traditional medicines that impact on ways of being, health, human life and well-being. Flooding of low-lying areas not only impacts infrastructure and precious cultural heritage such as gravesites but also causes salinization of freshwater tables that then impinge on potable water—another critical human need or right. Furthermore, increases in ocean temperatures and ocean acidification induces reef degradation, increased coral bleaching and outbreaks of crown-of-thorns starfish (all interconnected); these effects cascade into fishing resources being diminished and marine wildlife losses. This then presents challenges to ways of being, traditional and cultural food sources, and people's diet, negatively impacting human health.

One poignant example from the Vanuatu climate rights study, is of cascading impacts caused by the destruction of the yam, a traditional root crop and staple food widely used in Vanuatu and elsewhere in the Pacific Islands region. One participant from Ambrym Island explained how yam is the 'main commodity of value for exchange' and that the 'rituals, rites, and customs of the yam… are the main social fabric that holds our kinship, tribe and communities, and society, together' (participant number 61). The deterioration and physical loss of the yam due to increased climate variability and extreme weather has impinged on human rights on multiple fronts, violating Vanuatu's social fabric, culture and traditions, agency, identities and food security:

> *"The yams are significant in our culture. Its harvest is marked by special cultural rituals and ceremonies, but the climate had affected the harvest sessions which resulted in a big delay in harvest and that makes people lose their normal cultural rhythm and ritual… The cultural ways of planting are not adaptive to these fast changes caused by the climate which is now leading to a loss of cultural practices and knowledge. This is a cultural right that can never be recovered and re-built if we lose it due to climate change. No financial means can recover those non-economic losses, which are our heritage and dignity. And climate change is taking these rights away from us."*

In total, the study found that at least nine fundamental human rights that are protected under a range of international laws and covenants have been undermined by climate loss and damage:

[40] https://www.nature.com/articles/s41558-023-01831-0

- Local environment (that is, land, sea, rivers, forests, biodiversity, and the ability of people to own, use, develop and control their lands) UNDRIP (Articles 2, 26.1 and 29.1)[41]
- Property and communal assets (that is, individual property, such a homes and boats, and communal assets such as wells, bores, nakamals and schools) UDHR (Article 17)[42]
- Standard of living (that is, access to food and water, education, reliable income and work, means of subsistence, social and health services, and physical and mental health) UDHR (Articles 23–26), ICCPR (Article 1.2)[43], ICESCR (Articles 1.2, 6.1, 11.1, 11.2, 12.1 and 13.1)[44] and UNDRIP (Articles 14.2, 21.1 and 24.2)
- Family and social cohesion (that is, to have a family, as the natural and fundamental group unit of society, and the bonds and bridges that bind community life) UDHR (Article 16), ICCPR (Articles 23.1 and 23.2) and ICESCR (Article 10.1)
- Cultural life, traditions, customs and traditional knowledge (that is, spiritual and religious traditions, traditional medicines and the ability to pass these down through generations); UDHR (Article 27), ICESCR (Article 27) and UNDRIP (Articles 8.1, 11.1, 12.1, 13.1, 24.1 and 31.1)
- Freedom, peace and security (that is, to live as a distinct people and not be subjected to any act of violence or harm); UDHR (Article 3), ICCPR (Article 6.1) and UNDRIP (Articles 7.1 and 7.2)
- Self-determination and agency (that is, the ability of people to freely pursue economic, social, and cultural development, participate in decision-making, and freely make decisions about their life and the things that affect it); ICCPR (Article 1.1), ICESCR (Article 1.1) and UNDRIP (Articles 3, 20.1, 23 and 32.1)
- Identity (that is, the things that contribute to people being who they are and what they value in accordance with customs and traditions);UNDRIP (Article 33.1)
- Sense of place and ‘home’ (that is, any disruptions caused by displacement, relocation or migration); UDHR (Articles 13 and 15), ICCPR (Article 12.1) and UNDRIP (Articles 6, 9 and 10)

Non-Economic Loss and Damage often involves the erosion of indigenous language. Vanuatu has well over 100 indigenous languages[45], making it one of the world's most linguistically diverse countries. Indigenous communities scattered throughout the nation have unique, and place-based cultures and languages that have thrived over time. However, due to the impacts of climate change, many areas in Vanuatu, both coastal and mountainous are becoming uninhabitable, forcing indigenous communities to move from ancestral lands permanently or temporarily.

One consequence is that different linguistic groups are being brought closer together in fewer habitable areas, which is resulting in a decline in the use of indigenous languages as indigenous communities adjust to their new surroundings[46]. Words associated with

[41] https://www.un.org/development/desa/indigenouspeoples/declaration-on-the-rights-of-indigenouspeoples.html
[42] https://www.un.org/en/about-us/universal-declaration-of-human-rights
[43] https://www.ohchr.org/en/instruments-mechanisms/instruments/international-covenant-civil-and-political-rights
[44] https://www.ohchr.org/en/instruments-mechanisms/instruments/international-covenant-economic-social-and-cultural-rights
[45] https://openresearch-repository.anu.edu.au/handle/1885/14819
[46] https://minorityrights.org/programmes/library/trends/trends2019/vanuatu/

particular geographical assets and place-based ecosystems are also being lost. As indigenous languages gradually disappear, so too does the cultural identity and sense of self of the community.

Vanuatu also faces significant loss and damage from slow onset events such as sea level rise, ocean acidification, and prolonged droughts. These gradual but persistent changes are eroding coastlines, leading to the displacement of communities and the loss of arable land essential for food security. Unlike very visible, and news-generating hazards like tropical cyclones, these slow onset hazards happen almost imperceptibly yet have equally devastating consequences. These slow onset events have cumulative and compounding effects, steadily eroding the resilience of Vanuatu's ecosystems and communities.

For example, as sea levels rise, saltwater intrusion into freshwater resources compromises drinking water and agricultural productivity, undermining livelihoods and exacerbating food and water insecurity. Ocean acidification is damaging coral reefs, which are crucial for biodiversity, fisheries, and the tourism industry, thus threatening both the natural environment and economic stability. Prolonged droughts disrupt traditional farming practices, reduce crop yields, and increase the dependency on imported food, further straining local economies.

Vanuatu is now holistically considering the very real non-economic impacts which are exacerbating other climate and non climate threats facing an already vulnerable population.

See Chapter 4 (Adaptation) for a more comprehensive review of **Vanuatu's Exposure to Climate Hazards** as well as **Observed and Potential Impacts of Climate Change, Vulnerabilities.** The tables in Chapter 4 (Adaptation) on **Climate Impacts and Actions for Vanuatu's Key Sectors and** provide clear examples of loss and damage occurring in Agriculture, Fisheries, Water, Tourism and Infrastructure.

Limits to Adaptation

In is important to note, however, that ni-Vanuatu people commonly continue to suffer even after all feasible adaptation efforts have been exhausted, or where adaptation options exist, but a community doesn't have the resources or enabling conditions to access or utilize them. For example, most communities in Vanuatu are investing time and resources into techniques and approaches that will help protect their crops and water supplies from climate change. These adaptation techniques are aimed at minimising the effects they feel, and the situation from spiralling out of control to one they cannot cope with themselves. But even if a community does everything it can to make its agricultural systems more resilient, experience demonstrates that a category 5 cyclone can uproot crops from the soil and demolish even the best implemented adaptation solutions. The loss and damage has been so severe in some instances that ni-Vanuatu farmers must re-start their agricultural activities from square one, or even shift into other livelihoods altogether. There is a clear demonstration across all sectors that the limits to adaptation have been, and continue to be, breached.

Despite the limits, adaptation, to date, has been the most important climate priority for Vanuatu as it seeks to minimise loss and damage that ni-Vanuatu people suffer. Most policies and strategies of government line agencies include priorities for adaptation, and adaptation features prominently in the National Climate Change & Disaster Risk Reduction

Policy 2nd Edition[47] as well as forms the bulk of Vanuatu's Revised and Enhanced Nationally Determined Contribution to the UNFCCC[48].

Numerous national projects and programmes have adaptation at their core, for example the SPC-GIZ Coping with Climate Change in the Pacific Islands Region (CCCPIR)[49] project that ran from 2010-2018 in Vanuatu and was a pioneer in piloting diverse adaptation strategies in sectors like livestock with climate tolerant pig breeding, in fisheries management with coral reef mariculture[50] and backyard tilapia production[51], in agriculture with solar crop drying[52] and climate smart agricultural practices. Newer programs such as the GCF-funded Climate Information Services for Resilient Development Planning in Vanuatu (Van-KIRAP)[53] from 2016-2024 and the GEF-funded Adaptation to Climate Change in the Coastal Zone in Vanuatu – Phase II (VCAP II) project[54] from 2022-2028, are building on these early successes and expanding adaptation opportunities to communities nationwide.

However, as Vanuatu continues to experience loss and damage, we have found that there is a point with the increasing severity and frequency of climate changes at which adaptation options are limited, become ineffective or fail outright. Thus there are limits to adaptation in all sectors and at all levels in Vanuatu.

Vanuatu faces both hard and soft limits to adaptation in addressing climate loss and damage. Hard limits refer to the absolute constraints beyond which adaptation is no longer feasible. For Vanuatu, these include the irreversible loss of land due to sea level rise and coastal erosion. Despite efforts to construct seawalls and implement other coastal defences, the relentless advance of the ocean means that some areas will inevitably become uninhabitable. This physical reality makes relocation the only option for many communities, presenting a significant challenge given the cultural and emotional ties to ancestral lands.

Soft limits, on the other hand, are barriers that can potentially be overcome with sufficient resources, planning, and changes in policy. In Vanuatu, these include financial, technical, and institutional constraints. The high cost of advanced adaptive infrastructure and the technical expertise required for effective implementation are often beyond the reach of local governments and communities. Additionally, geographical separation, communications breakdowns, and limited institutional capacity hinder the timely and effective execution of adaptation strategies. For instance, the reliance on international aid, which is often fragmented and insufficient, highlights the need for more coordinated and sustained financial support to overcome these soft limits.

Cultural and social dimensions also present significant limits to adaptation in Vanuatu. The relocation of communities due to climate impacts disrupts social structures and threatens the preservation of cultural heritage, language and traditional knowledge, which are vital to the identity and resilience of the Ni-Vanuatu people. Moreover, gender dynamics, where

[47] https://www.nab.vu/document/vanuatu-national-ccdrr-policy-2022-2030-2nd-edition
[48] https://unfccc.int/documents/578782
[49] https://www.giz.de/en/worldwide/14200.html
[50] https://panorama.solutions/en/solution/coral-gardening-climate-change-adaptation-vanuatu
[51] https://fame-archive.spc.int/doc/meetings/2013_Vanuatu_Climate_Workshop/Vanuatu_Climate_Workshop_2013_Report.pdf
[52] https://unfccc.int/climate-action/momentum-for-change/activity-database/momentum-for-change-vanuatu-women-lead-on-climate-adaptation-innovation-in-solar-fruit-drying
[53] https://www.greenclimate.fund/project/fp035
[54] https://www.thegef.org/projects-operations/projects/10415

women and young women are often marginalized, pose challenges to inclusive adaptation efforts.

In short, loss and damage is a part of a continuum that begins with averting the crisis by reducing climate change-causing green house gas emissions, minimising the impacts by adapting, and eventually and often simultaneously, addressing the inevitable loss and damage that communities and families suffer. The 6th Assessment Report of the Intergovernmental Panel on Climate Change IPCC confirms[55] that if more effort is expended by high emitting countries to avert and minimise risks, there will be less loss and damage. The reality however, is that those most responsible have been denying and delaying adequate action since before the UN climate convention was developed.

Disproportionate gender equality, disability, and social inclusion (GEDSI) L&D

Vanuatu's women and girls rely significantly on the coral, sea grass, and mangrove ecosystems for their livelihoods, spiritual, customary, and social protection purposes56. Due to traditional gender roles dictated division of labour, while both men and women engage in daily farming activities for income source, women are primarily responsible for selling produce in village and urban markets. They are widely regarded as the "mamas of the market" and make up the majority of market vendors in Vanuatu underscoring their high reliance on these ecosystems to support their subsistence and livelihoods57. For instance, in 2011, heavy rains ruined Vanuatu's mango crop, reducing the income of Vanuatu women who sold fruits at the local markets58.

Women's vulnerability is further exacerbated by existing gender inequalities and social norms that marginalize women's voices and leadership. This, in turn, undermines their ability to fully participate and benefit from loss and damage response efforts, violating their human rights. As these ecosystems are vulnerable to the impacts of climate change, women and girls are disproportionately affected by climate-related disasters. The loss of coral, sea grass and mangrove ecosystems (and associated loss of family income) is having a disproportionately negative impact on ni-Vanuatu girls coming from poor families as school fees are commonly paid only for eldest sons where household finances are limited. School fees are often the biggest barrier identified that is stopping girls from accessing and completing secondary education.

Other particularly vulnerable groups, including people with living with a disability, children and youth, the elderly and LGBTQ+ individuals face particular challenges and unique needs, as well as being important agents of change and action to address loss and damage.

Planning for disaster risk reduction and climate change resilience must include persons with disabilities at the national, provincial and community levels. Evidence from Vanuatu indicates that persons with disabilities experience greater risk in a disaster. They are less likely to evacuate safely and without injury due to a lack of accessible information regarding evacuation processes, and limited availability of accessible evacuation shelters. Persons with disabilities are not always included adequately in community or national disaster risk reduction planning and response processes or structures such as Community Disaster and Climate Change Committees, and Clusters.

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55 https://www.ipcc.ch/2023/03/20/press-release-ar6-synthesis-report/
56 https://researchonline.jcu.edu.au/15072/2/02_Chapters_1-6.pdf
57 https://actionaid.org.au/wp-content/uploads/2019/11/Monash-GRACC-Report-Vanuatu.pdf
58 Vanuatu Women Lead on Climate Adaptation Innovation in Solar Fruit Drying – Vanuatu | UNFCCC

Children and future generations are bearing, and will continue to bear, the brunt of the impact on a polluted, degraded planet. Climate change and its effects on ni-Vanuatu youth is fast becoming a critical issue. Some of the leading killers of children worldwide are highly sensitive to climate change. Higher temperatures have been linked to increased rates of malnutrition, cholera, diarrhoeal disease and vector-borne diseases like dengue and malaria. Children's underdeveloped immune systems put them at far greater risk of contracting these diseases and succumbing to their complications. Additionally, the loss of a parent or home due to a climate change-induced natural disaster certainly changes a child's world but it also can jeopardise their development.

The lesbian, gay, bisexual, transgender, queer, intersex, asexual and ally (LGBTQIA+) community is one such group, which, because of its social vulnerability, is a hidden victim of climate loss and damage to a wide extent. LGBTQIA+ individuals are uniquely vulnerable to exclusion, violence and exploitation because of the cumulative impacts of social stigma, discrimination and hatred. The social stigma around the LGBTQIA+ community also makes loss and damage relates support, social opportunities and infrastructure unavailable to them. The roots of loss and damage inequality are tied into the roots of multiple oppressions.

Policies, Legislation and Governance Relevant to Loss & Damage

The Meteorology, Geological Hazards and Climate Change Act No. 25 of 2016[59], establishes the National Advisory Board on Climate Change & Disaster Risk Reduction (NAB) to serves as the supreme governance and policy making body for all climate change and disaster risk reduction (CCDRR) programs, projects, initiatives. The overall aim of this multi-sectoral governance mechanism is to integrate the governance of CCDRR in a holistic way to reduce duplication and strengthen strategic oversight.

The NAB is comprised of director-level officials from across government machinery, including the director responsible for subnational and area governments in all provinces. The NAB also includes representatives from civil society and the private sector. To facilitate its work, the NAB has established a Technical Working Group on Adaptation and Loss & Damage, which in turn is operationalised through an active Informal Working Group on Loss & Damage. All policies, projects, programmes and initiatives related to Loss & Damage, including UNFCCC and Paris Agreement related positions, are developed under the oversight of this loss and damage group. Decisions are then formally endorsed by the NAB. The Loss & Damage Group is diverse in its membership, and includes representatives from Government, Civil Society, the Private Sector, Academic Organisations, and International organisations. As a guiding principle, the Loss & Damage group attempts to take a bottom-up locally-led and inclusive approach as a foundation to its work.

The Disaster Risk Management Act No 23 of 2019[60] regulates the management of disasters and for related purposes, including establishing the National Disaster Committee, which is comprised of 9 senior officials from key government departments, the police and the Red Cross, and is tasked with advising the responsible Minister on all matters relating to disasters and overseeing the implementation disaster policies and

[59] https://www.vmgd.gov.vu/vmgd/images/admin-media/docs/Official-Gazette-No.-6-of-2017-dated-1-February-2017.pdf
[60] https://ndmo.gov.vu/images/download/DRMAct2019/DRM_Act_23_of_2019.pdf

strategies. The Act also defines the role of the President in declaring a State of Emergency upon the advice of the Council of Ministers.

Vanuatu's updated Climate & Disaster Risk Reduction Policy[61] includes section 7.4.4 on Loss & Damage, with the objective to establish mechanisms to assess and redress loss and damage incurred as a result of climate change. The policy acknowledges that dialogue has been undertaken on a broader concept of risk reduction, sharing and transfer, insurance and rehabilitation, through international platforms such as the Warsaw International Mechanism for Loss and Damage, and outlines seven key action areas:

- Strongly advocating internationally and domestically to operationalise and implement action under the Warsaw International Mechanism for Loss and Damage.
- Developing a loss and damage implementation framework, including risk sharing, insurance and compensation approaches at replacement value.
- Conducting assessments on potential and actual loss and damage across the country linked with ongoing vulnerability assessment processes.
- Determining priority Vanuatu sectoral issues and quantifying losses (e.g., food security, culture, ecosystem services and integrity.
- Mainstreaming loss and damage into land and relocation policies and laws.
- Providing clarity on enforcement of and the mandate for climate proofing development among government line agencies.
- Ensuring that the design and construction of public and other major infrastructure and development projects consider current and projected risks in order to minimize loss and damage, especially by developing and adhering to climate-proofed building codes, environmental impact assessments, regulations and development guidelines.

The **CCDRR Policy Implementation Plan** highlights the external financial and technical assistance need to "analyse best practices and recommend loss and damage frameworks for priority sectors," and includes several Thematic Programs relevant to Loss & Damage:

Thematic Program 1: Improving Governance for Climate Chance and Disaster Resilience

- 1.1.2. Incorporate loss and damage calculation methodology into land and relocation policies and laws, and establish loss and damage registry to track overall damages and to inform Vanuatu's international stance on loss and damage
- 1.2.5. Develop white paper analysis recommending an advocacy framework for Vanuatu on the Warsaw International Mechanisms for Loss and Damage
- 1.3.1. Review and update the National Disaster Act of 2006 and enact new legislation as appropriate.

Thematic Program 2: Improving Planning and Implementation for Climate Change Adaptation and Disaster Risk Reduction at Subnational Levels

- 2.1.5. Develop and disseminate standard operating procedures (e.g., standard manual for emergency water supply at the provincial and community level to enhance disaster preparedness
- 2.4.3. Develop guidelines and user-friendly tools for provincial, municipal and local levels to guide preparedness procedures, emergency drills, and relief distribution

Thematic Program 4: Increasing Financial Support and Management in Climate Change and Disaster Risk Reduction, with an objective to "Establish enabling conditions and pilot innovative programs for insurance, risk sharing, and calculation of loss and damage"

[61] https://www.nab.vu/document/vanuatu-national-ccdrr-policy-2022-2030-2nd-edition

- 4.4.2. Design and implement a mechanism for inventorying and quantifying loss and damage due to climate change impacts based on emerging best practice and in alignment with guidance from the Warsaw Implementation Mechanism for Loss and Damage; incorporate summary analysis of L&D into UNFCCC communications, COP negotiating strategies and updates, and LDC group discussions
- 4.4.3. Conduct a review of insurance/risk sharing case studies and best practices including public and private sector models, and develop briefing materials for decision makers
- 4.4.4. Conduct feasibility study and market analysis for selected mechanisms, including public and private sector options
- 4.4.5. Design and seek partners for pilot program for insurance/ risk sharing

Thematic Program 7: Assessing and Reducing Vulnerability at all levels
- 7.1.1. Develop a standardized methodology and guidelines for conducting community-level multi-hazard risk and vulnerability assessments.
- 7.1.3. Adapt existing National Vulnerability Assessment framework to be applied for sectoral vulnerability and risk assessments. Define common hazards and threats (slow and sudden onset) to be assessed.
- 7.2.4. Conduct analysis of emerging best practices and deliver white paper with recommendations for establishing sectoral loss and damage frameworks, including costing methodologies

Thematic Program 8: Enhancing the Role and Competencies of Non-Government Stakeholders for a Whole-of-Society Response to Climate Change and Disasters.
- 8.2.2. Implement business continuity training (BCT) with VCCI including training of trainers (ToT) program for local facilitators and semi-annual BCT workshops for private sector stakeholders
- 8.2.6. Conduct scoping study and publish white paper with suggested models and regulatory requirements to support CCDRR insurance or other risk sharing mechanism

Thematic Program 9: Strengthening Disaster Preparedness, Response, and Recovery, which has four primary objectives, all related to loss and damage:
- Improve the national early warning system, including technical, operational, coordination, and human capacity aspects; 9.1.1-9.1.5
- Enhance disaster preparedness and improve prepositioning supplies and logistics to cover all areas of Vanuatu;9.2.1 – 9.2.6
- Government and communities have enhanced capacity to develop and maintain safe, dignified evacuation options in emergencies;9.3.1-9.3.8
- National and local authorities utilize accurate data to plan for, respond t, and recover from displacement.9.4.1-9.4.7

The preamble of **Vanuatu's National Policy on Climate Change and Disaster-Induced Displacement**[62] begins with "Sudden and slow-onset disasters are increasing features of Ni-Vanuatu life. Disasters can have devastating effects on the livelihoods, physical security and well-being of communities and threaten the survival of socio-cultural systems." The policy itself includes numerous policy priorities around displacement, relocation and migration across various sectors and with a range of stakeholders.

In 2024, Vanuatu adopted a **National Adaptive Social Protection Policy**, with actions and indicators related to addressing climate loss and damage, including contributing to reducing vulnerability to environmental shocks by integrating early warning systems with adaptive social protection programs supporting the people of Vanuatu, with particular focus

[62] https://www.iom.int/sites/g/files/tmzbdl486/files/press_release/file/iom-vanuatu-policy-climate-change-disaster-induced-displacement-2018.pdf

to those most vulnerable, and promoting government-led investments in the resilience capacities of households who are particularly vulnerable to shocks through social protection programs including cash transfers. The policy prioritises programs that build community resilience to prepare, cope and adapt to disasters and shocks through disaster preparedness and recovery, protecting livelihoods and promoting economic recovery after disasters.

In 2024, Vanuatu adopted a **Disaster Risk Financing Policy** developed to assist in understanding, assessing, and planning for the natural disasters. The Policy provides a framework to protect and safeguard the people and the economy from adverse impacts of disasters through the use a set of disaster risk financing instruments. Collectively, these instruments provide liquidity and budgetary support in the event of a climate disaster.

Vanuatu's 3rd National Communication to the UNFCCC[63] makes it clear that "climate change is the most critical existential threat of our time, and its adverse impacts pose significant threats to the sustainable livelihoods and wellbeing of Vanuatu's people."

In 2022, Vanuatu revised and updated its **Nationally Determined Contribution to the Paris Agreement**[64], critically including both adaptation and loss and damage targets for the first time. In total, Vanuatu's NDC includes 20 Mitigation commitments, 116 Adaptation commitments, and 12 Loss & Damage commitments to meeting the goals of the Paris Agreement (see section below for an assessment on L&D NDC implementation progress).

The **Statistical development plan for Vanuatu disaster-related statistics 2024–2028**[65] aims to coordinate, collate, produce, and disseminate quality and timely disaster-related statistical information for managing and reporting on the risk, occurrence, and impact of major disasters in Vanuatu, including to produce a minimum set of disaster-related statistics that will meet national, regional and international needs for disaster-related statistics.

Vanuatu is currently undertaking a programme to develop a **National Adaptation Plan and Provincial Adaptation Plans** to enhance adaptation planning processes with support from a GCF Readiness Grant and implemented by the Global Green Growth Institute (GGGI). It is expected that the NAP will fully integrate loss and damage in the context of limits to adaptation.

Vanuatu is currently developing a standalone **Loss & Damage Policy Framework and Implementation Plan** with the support of GGGI and the UK's Small Island Developing States Capacity and Resilience Programme (SIDAR), which aims to provide a high-level and forward looking programme of action to guide Vanuatu's evolving loss and damage commitments and on-ground action. The Loss & Damage Policy Framework will clarify the linkages among adaptation, humanitarian and recovery sectors, and provide high-level, forward looking and locally led approaches for a new and unpredictable future. This is to ensure that Vanuatu is enabled to enact important reforms domestically to ensure that the losses and damages to families, communities and even the largest infrastructure and economic sectors are addressed fairly and equitably.

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[63] https://unfccc.int/sites/default/files/resource/Vanuatu%20Third%20National%20Communication%20Report.pdf

[64] https://unfccc.int/sites/default/files/NDC/2022-08/Vanuatu%20NDC%20Revised%20and%20Enhanced.pdf

[65] https://vbos.gov.vu/sites/default/files/NSDS%3B%20Disaster%20Related%20Statistics%202024-2028.pdf

At the regional level, at the regional level, the **Framework for Resilient Development in the Pacific**[66] is one of the first inter-governmental agreements that bring together the Sendai Framework, Paris Declaration and the UN SDGs. While loss and damage is not specifically referenced as a concept, the intention of the FRDP is to ensure that climate and disaster impacts are holistically considered and addressed collectively.

Loss & Damage is also implicit in the **2050 Strategy for the Blue Pacific Continent**[67], which Leaders of the region have endorsed within the Pacific Island Forum. The 2050 Strategy sets out a long-term approach to working together as a region, with leaders articulating their vision for a resilient Pacific Region of peace, harmony, security, social inclusion and prosperity, that ensures all Pacific peoples can lead free, healthy and productive lives. In the document, there is a specific pathway on Resilience & Wellbeing, as well as a Thematic Area on Climate Change & Disasters.

Pacific Island Leaders communiqués have reaffirmed that climate change remains the single greatest threat to the livelihoods, security and wellbeing of the peoples of the Pacific and a commitment to progress the implementation of the Paris Agreement (**Boe Declaration in 2018**[68]**, Kainaki II Declaration in 2019**[69]). In 2021, leaders endorsed the **Declaration on Preserving Maritime Zones in the Face of Climate Change-Related Sea-Level Rise**[70] to proclaim existing maritime zones, and the rights and entitlements that flow from them, shall continue to apply, without reduction, notwithstanding any physical changes connected to climate change-related sea-level rise.

In 2023, Leaders endorsed the **Pacific Regional Framework on Climate Mobility**[71] to guide Pacific Islands Forum governments, communities, non-state actors and partners in ensuring rights based and people-centred movement in the context of climate change, including staying in place, planned relocation, migration, and displacement through a proactive, inclusive and collaborative regional approach that reflects common Pacific interests in a culturally appropriate manner, while respecting national sovereignty and diversity.

Domestic Action to Address Loss & Damage

Given the severity, and often existential nature of the climate losses and damages to the people of Vanuatu, a range of actions have been undertaken to address these impacts, often directly by communities, local private sector actors and government departments. Based on this experience, an initial typology of actions to address loss and damage has been developed, and being further refined. The following section provides concrete examples of several of these relevant actions that address climate loss and damage in Vanuatu.

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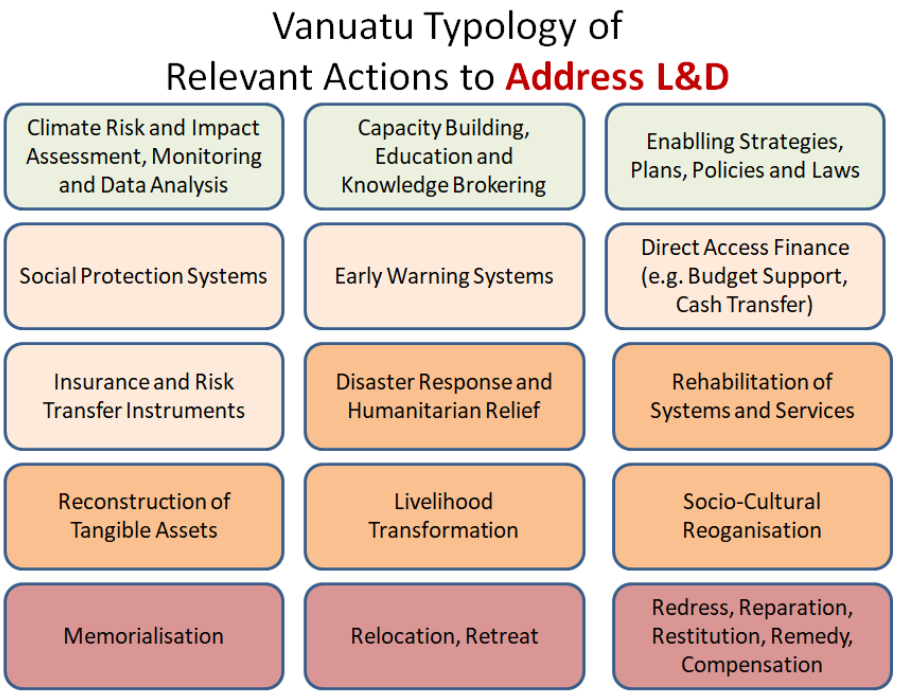
66 https://www.resilientpacific.org/en/framework-resilient-development-pacific
67 https://forumsec.org/2050
68 https://www.forumsec.org/2018/09/05/boe-declaration-on-regional-security/
69 https://www.forumsec.org/2020/11/11/kainaki/
70 https://forumsec.org/sites/default/files/2024-05/2021%20Declaration-on-Preserving-Maritime-Zones.pdf
71 https://forumsec.org/sites/default/files/2024-02/Pacific%20Regional%20Framework%20on%20Climate%20Mobility.pdf



New Modalities for Direct Access by Vulnerable Individuals

Vanuatu's Blockchain-powered Cash Transfer Programme[72] has been trialled and implemented with the intention to disperse finance directly to households and individuals. This innovative financial equity transfer system has been established alongside local private sector and civil society actors, and allows for a better distribution of goods and services to those most vulnerable. Beneficiaries are credited with funds and then are empowered chose the goods that best suits their recovery needs and pay local vendors who they know and trust via a "tap and pay" card or from their mobile phones. Vendors are provided with smart phones and trained on how to use them to accept card-based payments, and importantly, all transactions, including what is being purchased and where, is fully traceable, monitored by all donors and implementers.

The approach has been utilized in the remote area supported by the Santo Sunset Environment Network[73], an indigenous-led network, convenes community disaster and climate change committees across 42 indigenous villages in remote Santo Island to mobilize action across large scales that simplify government entry and support. The network actively works to assure women's leadership and gender inclusivity in their efforts to address climate change.

Moving forward from an initial trial by non-government actors (including NGOs and local businesses), the government has decided to create its own cash transfer system using the Vanuatu Post[74]. This decision was taken, as the pilot used proprietary financial software which was deemed by government to be too expensive and restrictive. A private firm was hired to create new systems for the Government, but the rollout has been delayed for capacity, financial and technical reasons.

Micro-Insurance Products

[72] https://www.vbrc.vu/unblocked-cash
[73] www.SantoSunset.org
[74] https://www.dailypost.vu/news/government-defends-cash-transfer-initiative/article_403d2ba9-b1f5-50f0-ab24-883ffd3083ca.html

While insurance is not a silver bullet, or even a major answer to the problems faced in Vanuatu, new initiatives are beginning to look at micro insurance as part of the solution space. Currently, there is no commercially available insurance mechanism to finance slow onset losses and damages partly because these events do not have a clearly defined "trigger" that signals the need for mobilization. However, few insurance companies in Vanuatu products that adequately meet the recovery costs of loss and damages incurred by climate events.

Insurance is not a viable option for most families in Vanuatu, as premiums are beyond the country's GNI per capita of $3,240 (2021)[75]. There is also a distrust of the insurance industry, seen with trepidation by many as a loan or an expense with no outcome. As a result, despite the high exposure to climate hazards, only a small percentage (5%) of people in Vanuatu has some kind of insurance coverage[76].

The UN Capital Development Fund (UNCDF) launched in 2022 a micro-insurance product in Vanuatu[77] designed to protect climate vulnerable populations such as the poor, women and girls, Ni-Vanuatu families, and people with disabilities, against the adverse financial impacts of extreme weather hazards. The product works by providing a quick injection of relief funds within 10-14 days following a natural disaster, and is aimed at Vanuatu's smallholder farmers, fishers, MSMEs, women-headed households, and people with disabilities.

The product was deemed a success after the twin Category 4 cyclones Kevin and Judy which struck Vanuatu says apart in March of 2023. There were 84 beneficiaries, out of the 122 that bought the product in the pilot phase, to receive the first historic payout of claims in Vanuatu totalling US$ 23,682[78].

One female beneficiary living in the capital city recounted receiving a payout within 14 days of the cyclone and the quick access to funds allowed her to repair the roof of her family home and restore normalcy in her life. A male farmer beneficiary used his payout to rebuild the farm, purchase new seeds, and resume selling his crops at the local market.

Moving forward, more effort will be expended to sensitize the local population on the use and benefits of insurance products, as well as investment in premium subsidies to make this solution available to the widest possible population, many of whom cannot afford additional risk transfer instruments.

Regional Catastrophic Risk Finance Pooling

Vanuatu was beneficiary of the Pacific Catastrophe Risk Assessment and Insurance Initiative (PCRAFI), when 2015 when Tropical Cyclone Pam triggered a US$1.9 million emergency cash injection[79]. Vanuatu received the funds within one week of the event to support the recovery process, including the mobilization of nurses to affected provinces.

The payout is based on a hybrid of parametric triggers and modelled loss approaches, which utilises parameters of actual events but takes a modelled the loss to define whether

[75] https://www.macrotrends.net/countries/VUT/vanuatu/gni-per-capita
[76] https://link.springer.com/article/10.1007/s11027-022-10002-z
[77] https://www.uncdf.org/article/7992/uncdf-launches-first-parametric-micro-insurance-product-for-climate-vulnerable-communities-in-vanuatu
[78] https://www.uncdf.org/article/8288/interest-in-parametric-insurance-growing-after-historic-first-payout-in-vanuatu
[79] https://www.worldbank.org/en/news/press-release/2017/03/31/pacific-islands-take-the-lead-on-financial-protection-from-disasters

it has been triggered. It demonstrates the important role that parametric triggers play in effecting rapid insurance payouts after disaster strikes.

This Pacific risk pooling facility was launched with the support of the Japanese Government, the World Bank, the Secretariat of the Pacific Community (SPC) and the Global Facility for Disaster Reduction and Recovery (GFDRR), and has since evolved into the Pacific Catastrophe Risk Insurance Company: PCRIC[80] of which Vanuatu is a member.

PCRIC uses a risk pool that is created by combining the insurance needs of individual nations into a single diversified portfolio of risk. Since it is highly unlikely that several countries will be hit by a major disaster within the same year, the diversification among participating countries creates a more stable and less capital-intensive portfolio. Additionally, the larger size of the collective pool generally means PCRIC is able to offer lower insurance premiums to Pacific countries than the insurance market would be able to offer if nations sought insurance coverage individually.

Policies taken out under this form of insurance are based upon the outcome of a 'catastrophe model' and is based on a number of parameters and metrics covering the type of catastrophe being insured – for example, tropical cyclone. Using this model allows the insurer to predict the value of losses likely to be incurred (the 'modelled loss') should an insured disaster occur, and agree with the insured party ahead of time the value of a payout to be made.

Though the amount may not fully cover the actual costs incurred, parametric insurance avoids the need for on-the-ground assessment before a claim can be settled, offers predictability and enables pre-planning of expenditures against a guaranteed amount.

Following a tropical cyclone, if the modelled loss as calculated by PCRIC's catastrophe model exceeds a pre-defined threshold, or 'trigger' then a payout will be made. This trigger is calculated to represent the magnitude of loss that would be expected to occur once every ten years on average (a "1-in-10-year event"), meaning every year a country has a 10% chance of a payout being due per policy held. For any modelled loss above the trigger, the amount of the payout increases as the modelled loss increases up to a pre-defined coverage limit per policy. This means higher payouts are due for more severe events.

Importantly, because the amount of the payout available is pre-agreed there is no need for payment to be withheld pending assessment of the disaster impact.

The Government has for several years not always been able to afford the premiums offered by PCRIC, even when heavily subsidised by international partners. It may be necessary to fully cover costs of Government participation in the scheme. Another area of work would be to ensure that payouts are used for specific, high impact investments, including community action to address loss and damage in lieu of spending on high capital items like infrastructure.

Community Relocation

From 2021 through 2023, when the world faced a rare multi-year La Niña (nicknamed a 'triple dip La Niña')[81], the ni-Vanuatu communities on Santo Island experienced a series of extreme rainfall events in the first two months of 2022, dumping nearly one metre of rain on an already soggy rainy-season landscape. Then, beginning on 23 February 2022, Western Santo villagers experienced three strong earthquakes, each over M 4.6.

[80] https://pcric.org/
[81] https://earthobservatory.nasa.gov/images/150691/la-nina-times-three

At 6pm on 9 March 2022, as a result of rain-drenched topsoil and the destabilising effects of the earthquakes over the previous weeks, the entire mountainside of the Indigenous village of Molpoi collapsed, sending topsoil, rock and debris more than 300m wide and 30m deep barrelling down the valley, over 2km to the ocean.

In less than one hour, the community of Molpoi had lost its coconut plantations (3,000 trees), cacao groves (3500 trees), water taro gardens, kava cash cropping sites, fruit orchards, livestock pastures and subsistence food plots. Thick mud blanketed the village, destroying homes, the community meeting hall, a local kindergarten and the village cemetery.

In the absence of an official response, the community was supported by a locally-based NGO, the Santo Sunset Environment Network to identify a relocation area, and have since moved all households away from the landslide area. Immediately after the first landslide, SSEN was the first organisation on the scene. It supported the Molpoi Community Disaster and Climate Change Committee to undertake initial disaster assessments, including on non-economic impacts, to channel through the official Ministry of Climate Change and National Disaster Management Office institutional arrangements[82].

Relocation is a difficult and expensive endeavour, which has devastating impacts on both the displaced population but also on the host/recipient communities. More work needs to be done to define thresholds for relocation, costs, non-economic consequences to culture and wellbeing, as well as approaches to ensure migration occurs with local ownership and dignity throughout the process.

Early Warning Systems for Minimising Flood Loss and Damage

The Vanuatu Meteorology and Geohazard Division under the Ministry of Climate Change currently manages the Vanuatu geophysical network which includes monitoring stations across the country, with the aim of providing reliable information that decision makers and general public can use to take immediate action to minimize climate impacts within an specific area.

With support of the GCF-funded Climate Information Services for Resilient Development in Vanuatu Project (VanKIRAP), new climate monitoring equipment was installed to provide climate information and early warning of severe weather events.

Specifically, an Automated Weather Station (AWS) was installed at the Vanuatu Agricultural Research and Training Centre in Luganville, and two Automatic Rainfall Gauges (ARG) were installed at the villages of Vunaspef and Sarakata Hydro to collect and provide more timely information to the Vanuatu Meteorology and Geohazards Department. Each of the new devices is equipped with three communication options—a Vanuatu Government wireless broadband modem, a cellular phone connection, and a satellite transmitter, making it possible to monitor the weather and water levels directly in these locations 24/7, no matter the conditions.

This investment marks a major advance for the people of Espiritu Santo Island because the new AWS and ARGs give early warnings before loss and damage occurs, which gives residents and authorities time to take decisive action to save lives and property. With advance information, people are able to make better planning decisions about building infrastructure, water usage, and transportation.

Working in combination with a The Flood Management Plan, Simulation Exercises and Capacity Building, the new ARGs and AWS provide automated early warning notifications

[82] https://openrepository.aut.ac.nz/items/a1287767-ac3f-4fa1-8a43-4e983d6cf267

that help the communities at each installation location prepare for natural disasters that might affect their livelihoods.

Moving forward more effort is required to extend early warning coverage to all remote areas of Vanuatu, and ensure that the general population has the information and capacity required to act on the information received.

Building Back Better through Traditional Knowledge

Many communities in Vanuatu are building resilience by using the post-disaster phases to restore physical infrastructure, societal systems and institutional structures, and revitalise livelihoods, economies and the environment in ways that reduce risk and strengthen recovery capacity.

For example, a project funded by UNESCO and implemented by the Vanuatu National Cultural Centre and Museum focused on understanding how traditional architecture and building practices actually minimised loss of life during category 5 Cyclone Pam[83]. They recognized the Intangible Cultural Heritage of the nakamal, or traditional meeting house, as well as its wind resistant design. They also highlighted the high risk of it being lost due to a variety of climate and non-climate factors.

With through research, the museum is now advocating for safeguarding the nakamal through measures, including natural resource management, retention and transmission of building know-how, and legal protection. Importantly the programme has documented the construction steps for building traditional cyclone-safe houses using indigenous knowledge.

Engineers[84], international universities[85],[86] and NGOs[8788] are now using these traditional designs to roll out cyclone safehouses in other parts of Vanuatu where this building knowledge may have already been lost.

The Vanuatu CCDRR Policy 2nd Edition[89] recognises the importance of traditional knowledge for maintaining the resilience of indigenous communities. The policy outlines priority activities including traditional knowledge research (collecting, analysing and storing TK) and integrating these knowledge systems into formal and informal school curricula. Such initiative has been purposely priorities in such away to retain and maintain the TK which is not only cultural heritage but being resilience in our context is perpetuate fundamentally on culture and traditional foundations. Further providing a valuable avenue for decision makers utilise TK in important decision making.

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[83] https://unesdoc.unesco.org/ark:/48223/pf0000248144.locale=es
[84] https://reporter.anu.edu.au/all-stories/disaster-ready-vanuatu-safehouse-to-blend-western-and-indigenous-engineering
[85] https://www.sciencedirect.com/science/article/pii/S2590061720300636
[86] https://www.researchgate.net/publication/315037188_Traditional_Cyclone_Shelters_in_Vanuatu
[87] https://www.sista.com.vu/erromango-village-prepares-for-2024-cyclone-season-through-traditional-architecture/
[88] https://espace.library.uq.edu.au/data/UQ_4606607/UQ4606607_OA.pdf?Expires=1716731620&Key-Pair-Id=APKAJKNBJ4MJBJNC6NLQ&Signature=C8zMjDNyG3vgA8gHVhBUUeIsTH0sg74ZkgDfDdujedg9ycmBtTI1xV0sj9QbDlJomLSLBPQPSa4B5h8TCi1Rqw38RuSw3XKIW63JoDDXOztLdq0iRoS5Ug1EK29tw~MXXS3CDxpghtmimpy65F29Mf603SeKF2AF2E0ar20sk4uutg8xmP~zEJJUskj9UpHFpLGR4w~ZQB48wgLwPgagvHlssv81Svo0mxkHhtwL4awlXEDVIqcTJuG4HvHORnkdLPloLy4iNIa2lQNbijRCvzlUydGY54rbscCZBetovHo4rmAeiC6JmXmSRzb0aU30Xnz9u9sQszGCO6nR-gnGbw__
[89] https://www.nab.vu/document/vanuatu-national-ccdrr-policy-2022-2030-2nd-edition

More effort is required to document the rapidly disappearing traditional knowledge used to address climate and non climate loss and damage. Faster climate change means that work to memorialise and share this knowledge must accelerate.

Quantifying Non-Economic Loss & Damage in PDNAs

Vanuatu has engaged extensively with loss and damage issues within the disaster context, conducting at least three post-disaster needs assessments (PDNAs), which have a more immediate and operational focus on the losses and damages experienced after extreme events. Vanuatu's efforts in PDNAs typically quantify the direct economic losses (e.g., infrastructure damage, loss of livelihoods) and identify the needs for humanitarian aid, reconstruction, and capacity building. While Vanuatu's disaster community has tried to consider non-economic losses, such as educational impacts and social disruption, the primary emphasis has been on economic needs assessments for recovery.

In the aftermath of category 5 Cyclone Harold, a group of experts from the Department of Environmental Protection & Conservation and the Secretariat of the Pacific Regional Environment Programme made a first ever assessment of the loss and damage to the environment and ecosystem services of forests, water systems and coral reefs to feed into the formal Post Disaster Needs Assessment process.

A base methodology was devised and in accordance with methodologies and guidance from the World Bank[90], but tailored to Vanuatu's contexts and data limitations.

Moving beyond narrative reports of cyclone Harold impacts on the environment, the team went further by assigning economic values to the economic effects on particular habitats and ecosystem services. Without full environmental baseline statistics, the team selected two ecosystems Forests and Marine for which Vanuatu has 1) robust GIS remote sensing baseline data 2) globally and nationally available economic values.

Quantification of the environmental services from the selected habitats and ecosystems is inherently difficult, as they include a range of economic and non-economic functions. In practice, total economic value is nearly impossible to calculate because the data required to do so are rarely available. While this attempt focused on quantifiable loss and damage, much was left out, due to methodological shortcomings, in regard to traditional knowledge and culture that suffered severe impacts.

The economic value of the TC Harold disaster on environmental services was calculated using a basic benefits-transfer methodology drawn from available economic valuation studies undertaken globally, in Vanuatu and used during TC Pam for the PDNA process (for example De Groot et al 2012[91] Global estimates of the value of ecosystems and their services in monetary units and Mackey et al 2017[92] Vanuatu Ecosystem and Socio-economic Resilience Analysis and Mapping (ESRAM)).

For both Forests and Marine Ecosystems, the Environmental PDNA experts calculated economic effects by estimating the area affected and multiplied this by an economic value per area, including discounting for future effects:

- Forest Loss was calculated at USD526,400/km2/yr * 15 Years
- Severe Forest Damage was calculated at USD263,200/km2/yr * 5 Years

[90] http://documents.worldbank.org/curated/en/773111493642626075/Post-disaster-needs-assessment-guidelines-environment

[91] https://www.sciencedirect.com/science/article/pii/S2212041612000101

[92] https://www.sciencedirect.com/science/article/pii/S2212041612000101

- Moderate Forest Damage was calculated at USD131,600/km2/yr * 0.5 Years
- Coral Reef Economic Value was calculated as the de Groot value 35,915,000USD/km2/yr
- Mangrove Economic Value was calculated as the de Groot value of 19,384,500USD/km2/yr
- Sea Grass Economic Value was calculated as the de Groot median value of 2,676,000USD/km2/yr
- Marine Loss was calculated at ecosystem value/km2/yr * 15 Years
- Marine Damage was calculated at ecosystem value/km2/yr * 5 Years

By estimating ecological loss and damage, the Government was able to put forward appropriate recovery strategies for impacted habitats and costed rehabilitation interventions for affected ecosystem services.

For the purposes of this PDNA, Damage was defined as the partial destruction of the physical habitat and the ecosystem. Damaged ecosystems experience impairment of the goods and services they are able to provide for human benefit. There is an economic effect associated with a damaged ecosystem which will last over a period of time (depending on the regenerative characteristics of the specific ecosystem and the severity of the damage). Loss was defined as the total destruction of the physical habitat and the ecosystem. Lost ecosystems experience full cessation of the goods and services they previously provided for human benefit. There is a total economic effect associated with a lost ecosystem, and no benefits will again flow until the ecosystem is able to completely regenerate, often over many years and depending on the growth/reproduction characteristics of the system. Forests and Coral Reefs take at least a decade, often much longer, to regrow from a total loss.

Formal methodological improvements must still be made, and PDNA coordinators and partners should place a renewed investment into including non-economic and environmental costs in the final tables and requests for international support.

Sources of Information on Loss & Damage

While full statistical information on loss and damage experienced in Vanuatu is not yet available, the following are important sources of information related to efforts to quantify and qualify the scale of loss and damage across the archipelago:

- Vanuatu Bureau of Statistics https://vbos.gov.vu/
- DesInventar https://www.desinventar.net/
- Emergency Events Database Em-DAT https://www.emdat.be/
- SPC PopGIS3 http://vanuatu.popgis.spc.int
- Pacific Data GIS Dashboard https://pacific-data.sprep.org/data-dashboard/gis-spatial-data-dashboard
- Pacific Map Tool https://map.pacificdata.org/
- Allen Coral Atlas https://allencoralatlas.org/atlas/#6.35/-16.7774/169.1281
- MacBIO Vanuatu Marine Atlas http://macbio-pacific.info/Interactive-Atlas/Vanuatu/Vanuatu.html
- GEOSS Portal https://www.geoportal.org/
- UNDRR Disaster losses and damages tracking DLDT https://www.undrr.org/building-risk-knowledge/disaster-losses-and-damages-tracking-system-dldt
- Coastal Risk Screening Tool https://coastal.climatecentral.org/
- Global Drought Information System https://gdis-noaa.hub.arcgis.com/
- NOAA 7 Day Rainfall Totals https://www.ospo.noaa.gov/products/atmosphere/ghe/ghe_loops.html?Imap=G&Itype=D&Inum=7?Imap=G&Itype=D&Inum=7

- Resource Watch Projections and Real Time https://resourcewatch.org/data/explore?section=All+data&selectedCollection=&zoom=6&lat=-17.235595646905544&lng=169.2932846966893&
- NASA Sea Level Projection Tool https://sealevel.nasa.gov/ipcc-ar6-sea-level-projection-tool
- NASA world view visualiser https://worldview.earthdata.nasa.gov/
- NOAA The Global Forecast System (GFS) https://www.ncei.noaa.gov/products/weather-climate-models/global-forecast
- SEDAC Hazards Mapper https://sedac.ciesin.columbia.edu/mapping/hazards/#
- Copernicus Global Flood Awareness System (GloFAS): https://global-flood.emergency.copernicus.eu/
- Global Forest Watch Deforestation Database https://www.globalforestwatch.org/dashboards/country/VUT/
- World Environment Situation Room (WESR) https://wesr.unepgrid.ch/?project=MX-XVK-HPH-OGN-HVE-GGN&language=en&theme=color_light
- World Bank Open Data https://data.worldbank.org/country/vanuatu
- World Bank Climate Knowledge Portal https://climateknowledgeportal.worldbank.org/country/vanuatu
- OCHA Humanitarian Data Exchange HDX Vanuatu data sources https://data.humdata.org/search?q=vanuatu&ext_search_source=main-nav
- Global Drought Observatory https://drought.emergency.copernicus.eu/tumbo/gdo/map/?id=2000
- GRID Data Analytics and Early Warning for Environment https://early-warning.unepgrid.ch/
- MapX visualising geospatial data on natural resources https://app.mapx.org/?theme=color_light&project=MX-YBJ-YYF-08R-UUR-QW6&language=en
- WHO Global Health Observatory https://data.who.int/countries/548
- UNDP Human Development Indicators https://hdr.undp.org/data-center/specific-country-data#/countries/VUT
- Glide Disaster Search https://glidenumber.net/glide/public/search/search.jsp
- ND-GAIN Vulnerability Index https://gain.nd.edu/our-work/country-index/rankings/
- Tropical Cyclone Database https://sharaku.eorc.jaxa.jp/TYP_DB/index_e.html
- Global Disaster Alert and Coordination System https://gdacs.org/
- Coastal Futures projections https://coastal-futures.org/

Loss and Damage projects and programmes currently underway and planned

Given Vanuatu's leadership on the issue of Loss & Damage, a range of regional and bilateral partners have commenced support to Vanuatu on its loss and damage action ambition and aspirations.

See Table 12 in Chapter 4 for a comprehensive list of Climate Change Adaptation Projects in Vanuatu, which also contribute to averting, minimising and addressing loss and damage in various ways.

The table below highlights the initial pipeline projects (currently underway and planned) that are focused primarily on loss and damage issues.

Project Title	Project Duration	Fiscal Volume	Implementing Entity	Donor	Key Loss & Damage Interventions	Status

Strengthening loss and damage response capacity in the Global South (STRENGTH) [93]	36 months 2023-2025	96,000 British Pounds (~14,500,000 VUV)	Vanuatu Department of Climate Change International Centre for Climate Change and Development (ICCCAD) Institute for Study and Development Worldwide (IFSD)	Canada's International Development Research Centre (IDRC)	Support the development of country-level loss and damage policy and implementation mechanisms, founded on collaborative research. • critical review of documented knowledge • country-level diagnostic studies and pilot actions • dialogues and knowledge exchange forums	Underway
Pacific Island Countries access to and absorption of Climate Finance[94]	2023-2025	In Kind; Technical Assistance ~US$ 400,000	Ministry of Climate Change Global Green Growth Institute (GGGI)	United Kingdom Small Island Developing States Capacity and Resilience Programme (SIDAR).	A range of support services, including: • Development of Loss & Damage Policy Framework and Implementation Plan • Long-term technical advisors to strengthen institutional capability to access, absorb and deliver impactful climate finance, • Strategic feasibility studies to strengthen climate finance implementation and knowledge sharing	Underway

[93] https://idrc-crdi.ca/en/project/strengthening-loss-and-damage-response-capacity-global-south-strength

[94] https://www.gov.uk/government/news/uk-supports-climate-finance-for-the-pacific

Addressing Climate Change Loss and Damage in the Pacific[95]	To commence in 2025 two years	4 million NZD	Ministry of Climate Change Tonkin & Taylor	New Zealand	Pacific Island Countries are supported and prepared to address the loss and damage they are experiencing due to climate change. • Assessment of L&D requirements • Establishment of L&D fund/funding window • Development of project pipeline • Capitalisation of fund/funding window	Approved; commencing soon
Development of a long-term nationally determined programme to address loss and damage in the Republic of Vanuatu under the Santiago network	To begin Q1 2025	US$ 330,000	OBNE to be selected by the SNLD Secretariat	Santiago Network on Loss and Damage	Capacity and L&D Finance Planning • National loss and damage visioning • Assessment of loss and damage capacity development needs • Approaches and methodologies for knowledge management, capacity building and communication • Request to the Fund for responding to Loss and Damage	Call for proposals currently open
Building Our Pacific Loss and Damage Response (BOLD Response) Project[96]	To begin in 2025, 5 years	19.7 mil € EUR shared among regional work, and in Marshall Islands, Samoa, Tuvalu, Vanuatu	Secretariat of the Pacific Regional Environment Programme (SPREP) Climate Analytics Australia-Pacific	German International Climate Initiative (IKI)	Build capacities to address Loss & Damage in the Pacific • Scientific basis for L&D Policies • Measuring non-economic loss and damage • Inclusion of L&D in national and regional Policies • Climate finance for loss and damage	Not yet approved, planning underway

[95] https://www.nzherald.co.nz/nz/politics/cop27-climate-change-conference-new-zealand-announces-loss-and-damage-funds-of-20-million/6SJVI5C425G7BDPUMBLILCQMSY/

[96] https://www.international-climate-initiative.com/en/find-funding/thematic-call/thematic-call-2022/

Assessment of progress on implementing the NDC Loss & Damage commitments

In 2022, Vanuatu revised and enhanced its NDC including both adaptation and loss and damage targets for the first time. The twelve Loss & Damage targets in Vanuatu's revised and updated **Nationally Determined Contribution to the Paris Agreement**[97] are outlined in the table below:

	Commitment	Sector Policy	Policy Reference	Conditionality (Expressed as %)	Finance Required USD
L1	Vanuatu commits to contribute to and engage constructively with the UNFCCC, Paris Agreement, Warsaw International Mechanism for Loss and Damage and associated committees, bodies and networks thereof.	CCDRR Policy	7.1.3 and 7.4.4	90	800,000
L2	Vanuatu commits to establish mechanisms to assess and redress loss and damage incurred as a result of climate change.	CCDRR Policy	7.4.4	100	110,000,000
L3	Vanuatu commits to developing a loss and damage implementation framework, including risk sharing, insurance and compensation approaches at replacement value by 2030.	CCDRR Policy	7.4.4	90	685,000
L4	Vanuatu commits to conducting assessments on potential and actual loss and damage across the country linked with ongoing vulnerability assessment processes, and quantifying losses (e.g. food security, culture, ecosystem services and integrity) (National CCDRR Policy 7.4.4), particularly though the Post Disaster Needs Assessment approach.	CCDRR Policy	7.4.4	100	1,900,000
L5	Vanuatu commits to ensuring that the design and construction of public and other major infrastructure and development projects consider current and projected risks in order to minimise, avert and address loss and damage, especially by developing and adhering to climate-proofed building codes, environmental impact assessments, regulations and development guidelines.	CCDRR Policy	7.4.4	90	2,500,000
L6	Vanuatu commits to implement affordable micro-insurance and "climate insurance" models to provide additional safety nets to remedy loss of income, damage to housing, infrastructure, crops and other assets from climate disasters.	Disaster Induced Displacement Policy	A10.8	100	22,000,000
L7	Vanuatu commits to facilitate community-led plans to ensure connections to ancestors and relatives buried in original locations are sustained, and as an important cultural aspect of relocation planning.	Disaster Induced Displacement Policy	A11.2	100	1,700,000

[97] https://unfccc.int/sites/default/files/NDC/2022-08/Vanuatu%20NDC%20Revised%20and%20Enhanced.pdf

L8	Vanuatu commits to provide continuing support for life-saving and essential health care to affected populations, including rapid measures to repair and/or rebuild damaged health facilities, and erect temporary health facilities with particular attention on restoring WASH infrastructure.	Health Cluster Strategic Plan	1.1	90	25,400,000
L9	Vanuatu commits to address the needs of and provide durable solutions for people affected by displacement, including people at-risk of displacement, displaced people, internal migrants, people living in informal settlements, and host communities (CCDRR Relocation Policy Strategic Area 10) by enabling ministries to work together to provide protections for people at each stage of the displacement cycle (CCDRR Relocation Policy Strategic Area 3).	Disaster Induced Displacement Policy	Area 10 & Area 3	100	9,000,000
L10	Vanuatu commits to careful consideration of planned relocation as an option of last resort, and where communities do need to move away from hazards, either temporarily or permanently, Vanuatu aims to ensure that lessons learned from previous relocation experiences globally and in the Pacific are considered, so that movement takes place with dignity and with appropriate safeguards and human rights protections in place.	Disaster Induced Displacement Policy	Action 3.7	100	685,000
L11	Vanuatu commits to expand its calls for finance to address the loss, damage, harm and injury suffered by our people and our nation resulting from climate change (including quantifiable as well as intangible and non-economic impacts) within the multilateral climate regime.	Climate Diplomacy Strategy	1.1	100	1,000,000
L12	Vanuatu commits to pursue finance and other forms of support for loss, damage, harm and injury resulting from climate change (including quantifiable as well as intangible and non-economic impacts), beyond the UNFCCC where the multilateral climate processes fail to adequately address the issue.	Climate Diplomacy Strategy	1.2	100	2,000,000

*Note on Conditionality. This percentage reflects the percentage of the total amount that would require external financing. 100% indicates that to achieve this target, full financing would be required from international sources. Any number less than 100% indicates that the Government of Vanuatu has already planned to partially cover the costs of this intervention.

The following table provides a qualitative assessment of the progress Vanuatu has made in implementing each L&D NDC commitment.

	Commitment	Status of Implementation	Key Gaps	Description
L1	Vanuatu commits to contribute to and engage constructively with the UNFCCC, Paris Agreement, Warsaw International Mechanism for Loss and Damage and associated committees, bodies and networks thereof.	Adequate	Finance is lacking. At present Vanuatu has no full time climate negotiators, limiting national ability to effectively engage with the UNFCCC	Vanuatu was actively involved in the 2024 review of the WIM, including by making a comprehensive submission. In 2023 Vanuatu made the first request for TA to the WIM's Santiago Network. Vanuatu has actively contributed to all UNFCCC COP and CMA negotiating sessions.
L2	Vanuatu commits to establish mechanisms to assess and redress loss and damage incurred as a result of climate change.	Deficient	Finance is lacking, Human Resource Capacity limited Tools and Methods needed to undertake long term loss and damage needs assessments. Limited legal capacities to pursue climate litigation and redress	Vanuatu is currently developing a Loss & Damage Policy Framework, as well as a national Loss & Damage Fund as new governance and financial mechanisms to better address climate impacts. These initiatives have not reached completion.
L3	Vanuatu commits to developing a loss and damage implementation framework, including risk sharing, insurance and compensation approaches at replacement value by 2030.	Deficient	Finance is lacking, Human Resource Capacity limited to mainstream loss and damage considerations in sector and subnational levels. Limited insurance products available, and limited knowledge/demand by stakeholders.	Vanuatu is currently developing a Loss & Damage Policy Framework and Implementation Plan. Small scale trails of micro-insurance products for farmers undertaken. Vanuatu has purchased climate risk policies from the Pacific Catastrophic Risk Insurance Company.
L4	Vanuatu commits to conducting assessments on potential and actual loss and damage across the country linked with ongoing vulnerability assessment processes, and quantifying losses (e.g. food security, culture, ecosystem services and integrity) (National CCDRR Policy 7.4.4), particularly though the Post Disaster Needs Assessment approach.	Deficient	Finance, Human Resource Capacity limited Tools and Methods needed to undertake long term loss and damage needs assessments that integrate multiple hazards and non-climate threats	Vanuatu has commenced innovation with the PDNA process to quantify biodiversity non-economic impacts. Currently there is no integrated data system or methodological synergy to capture the range of rapid and slow onset, economic and non economic impacts across the archipelago at various levels and among diverse stakeholder groups. The government has launched a Statistical development plan for Vanuatu disaster-related statistics 2024–2028.

L5	Vanuatu commits to ensuring that the design and construction of public and other major infrastructure and development projects consider current and projected risks in order to minimise, avert and address loss and damage, especially by developing and adhering to climate-proofed building codes, environmental impact assessments, regulations and development guidelines.	Deficient	Finance is lacking, Human Resource capacity limited in engineering, risk regulation and legal expertise.	Vanuatu's Vanuatu Infrastructure Strategic Investment Plan 2015 – 2024 fully mainstreams current and future climate risks into its strategic areas, and major new investments into roads, bridges and wharves have begun to implement these measures. Recent climate extremes and climate hazards, particularly associated with rainfall, have caused unprecedented erosion of critical infrastructure. Building codes (yr 2000) and House Construction Manuals (yr1990) are outdated and revisions are under development, but not yet approved or widely known or utilised. Environmental Impact Assessment protocols exist, but loopholes often see climate-risky developments proceed.
L6	Vanuatu commits to implement affordable micro-insurance and "climate insurance" models to provide additional safety nets to remedy loss of income, damage to housing, infrastructure, crops and other assets from climate disasters.	Deficient	Finance is lacking, Human Resource capacity limited in insurance approaches, parametric triggers, and risk transfer mechanisms	Small scale trails of micro-insurance products for farmers undertaken. Vanuatu has purchased climate risk policies from the Pacific Catastrophic Risk Insurance Company. An Adaptive Social Protection Policy and Disaster Risk Financing Policy were approved in 2024.
L7	Vanuatu commits to facilitate community-led plans to ensure connections to ancestors and relatives buried in original locations are sustained, and as an important cultural aspect of relocation planning.	Deficient	Finance, Human resource limitations in cultural aspects of relocation planning.	Government of Vanuatu is in the process of rolling out its Decentralisation Plan which aims to "bring government closer to the people", includes a strong focus on empowering ni-Vanuatu leaders at all levels of government to improve coordination and planning, so that people in local communities have better access to services. Currently a majority of Area Councils, the lowest level of government, are incorporating climate issues into the development plans. Often relocation is being discussed and planned as a response to worsening sea level rise and other climate hazards.
L8	Vanuatu commits to provide continuing support for life-saving and essential health care to affected populations, including rapid measures to repair and/or rebuild damaged health facilities, and erect temporary health facilities with particular attention on restoring WASH infrastructure.	Deficient	Finance is lacking, Human resource limitations in cultural aspects of relocation planning.	Vanuatu has established a Health and Nutrition cluster, which aims to reduce mortality and morbidity, and restore the delivery of preventive and curative health care as quickly as after climate related events in an equitable, sustainable manner.
L9	Vanuatu commits to address the needs of and provide durable solutions for people affected by displacement, including people at-risk of displacement, displaced people, internal migrants, people living in informal settlements, and host communities (CCDRR Relocation Policy Strategic Area 10) by enabling ministries to work together to provide protections for people at each stage of the	Deficient	Finance is lacking to implement relocation activities. Human Resources and expertise on relocation and migration issues is required in all sectors	Vanuatu is currently reviewing the National Policy on Climate and Disaster Induced Displacement, which aims to improve the governance and delivery of durable solutions related to migration and relocation. Little to no finance is available to implement the policy, and a Government lead agency to house the policy has not yet been identified

	displacement cycle (CCDRR Relocation Policy Strategic Area 3).			
L10	Vanuatu commits to careful consideration of planned relocation as an option of last resort, and where communities do need to move away from hazards, either temporarily or permanently, Vanuatu aims to ensure that lessons learned from previous relocation experiences globally and in the Pacific are considered, so that movement takes place with dignity and with appropriate safeguards and human rights protections in place.	Deficient	Finance is lacking to implement relocation activities. Human Resources and expertise on relocation and migration issues is required in all sectors	Vanuatu is currently reviewing the National Policy on Climate and Disaster Induced Displacement, which aims to improve the governance and delivery of durable solutions related to migration and relocation. Little to no finance is available to implement the policy, and a Government lead agency to house the policy has not yet been identified
L11	Vanuatu commits to expand its calls for finance to address the loss, damage, harm and injury suffered by our people and our nation resulting from climate change (including quantifiable as well as intangible and non-economic impacts) within the multilateral climate regime.	Deficient	Finance is lacking, Human resource expertise required in regard to climate finance, access and innovative sources, Technical assistance required on non-economic L&D. Tools and methods for fiscal planning and estimation.	Vanuatu has begun quantification and qualification of local loss and damage impacts, and the financial resources required to address them. Vanuatu quantified its climate needs in the revised and enhanced NDC, and will continue these efforts in the NAP under development, as well as the Loss & Damage Policy Framework and Implementation Plan.
L12	Vanuatu commits to pursue finance and other forms of support for loss, damage, harm and injury resulting from climate change (including quantifiable as well as intangible and non-economic impacts), beyond the UNFCCC where the multilateral climate processes fail to adequately address the issue.	Adequate	Finance is lacking. Human resources required for legal pathways to obtain finance, including to bring new cases in various jurisdictions to obtain reparation.	Vanuatu successfully brought a climate case on State climate obligations to the International Court of Justice. Vanuatu and COSIS obtained an important Advisory Opinion from the International Tribunal on the Law of the Sea on the obligations to provide remedy from greenhouse gas marine pollution. Vanuatu initiated an amendment process of the Rome Statute of the International Criminal Court to criminalise Ecocide and environmental loss and damage.

Finance, technology and capacity gaps and needs related to Loss & Damage

The following section builds on the financial analysis provided in Chapter 5 on Information on financial, technology development and transfer and capacity-building support needed and received under Articles 9–11 of the Paris Agreement. The information provided below seeks to highlight the current gaps in loss and damage financing, technology and capacity received in comparison the actual needs.

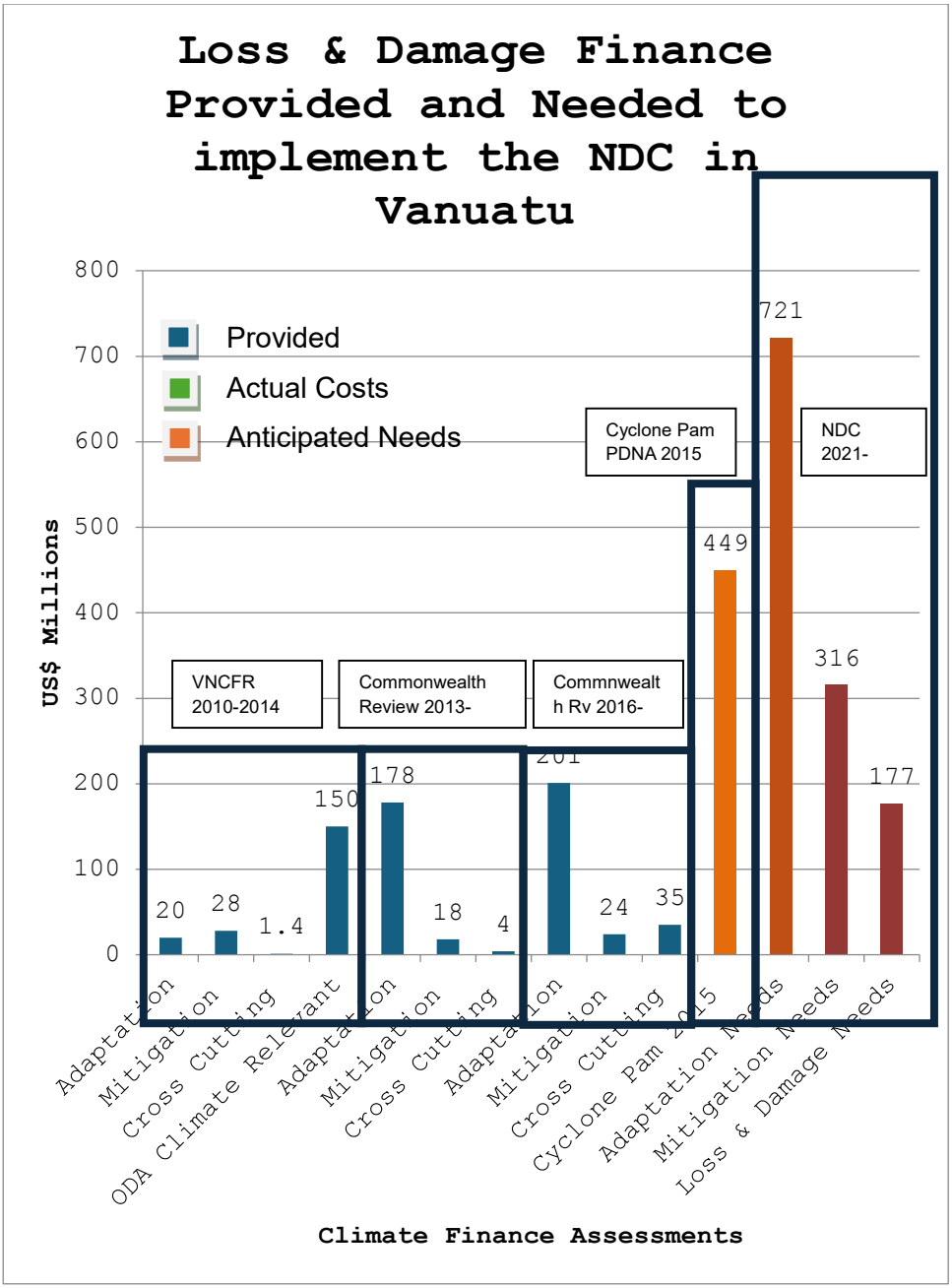
Finance Provided, Gaps and Needs

According to Vanuatu's National Climate Finance Review[98] and Vanuatu's draft Nationally Designated Authority NDA Project Development Handbook, from 2010-2014 an estimated US$ 50 million in grant finance was allocated to Vanuatu with an additional US$ 150 million allocated through ODA that included climate change as a "significant" but not primary objective. Of the US$ 50 million in grants to Vanuatu for climate change, US$ 28 million (57%) was for mitigation, US$ 20 million (40%) was for adaptation, and US$ 1.4 million (3%) was for cross-cutting projects.

From 2013-2017, an estimated US$ 200 million was committed for climate investments in Vanuatu, with US$ 178 million (89%) for adaptation, US$ 18 million (9%) for mitigation, and US$ 4 million (2%) for cross-cutting projects[99]. Most of this climate finance (56%) went towards infrastructure-related investments post-Cyclone Pam (e.g., climate proofing of major roads and wharfs), environment (27%) (e.g., agriculture, water, biodiversity, conservation), and energy (8%). Multilateral channels accounted for most of the finance (63%), nearly double what bilateral channels provided (37%). Instruments utilised were primarily concessional loans with some grants and technical support.

The Commonwealth Secretariat's Assessment of Vulnerable Sectors in Vanuatu[100] estimated figures of climate finance received between 2016- 2018 of US$ 259 million, with US$ 201 million (77%) for adaptation, US$ 24 million (9%) for mitigation, and US$ 35million (14%) for cross-cutting projects. They found that Multilateral channels (e.g., GEF, LDCF, WB, EDF) accounted for most of the finance provided, followed by bilateral channels (e.g. Australia, New Zealand, France, Canada).

[98] https://www.pacificclimatechange.net/sites/default/files/documents/Vanuatu_2018%20-%20Climate%20Change%20Finance%20Review%20Report.pdf
[99] https://mediamanager.sei.org/documents/Publications/Climate/SEI-WP-2017-04/SEI-WP-2017-04-Pacific-climate-finance-flows-FM.pdf
[100] https://www.thecommonwealth-ilibrary.org/index.php/comsec/catalog/book/985



As can be seen by all the analyses undertaken to date, finance for loss and damage is not yet adequately resourced and tracked as there is currently no dedicated national, bilateral, or multilateral facility yet operational to provide support. Neither the new UNFCCC Loss and Damage Fund[101] or the Santiago Network on Loss & Damage[102] are expected to be fully operational or financed before 2025. Similarly, Vanuatu's National Climate Finance Road Map (CFRM) 2021-2025[103] provides an overview of the country's short to medium-term goals and targets for strengthening access and management of climate finance, but does not yet fully incorporate Loss and Damage financing strategies.

101 https://unfccc.int/loss-and-damage-fund-joint-interim-secretariat
102 https://unfccc.int/santiago-network
103 https://drive.google.com/file/d/1NotFn-7N8YLuimsf5xa9se4Y22K_P-XZ/view

Vanuatu's Revised and Enhanced Nationally Determined Contribution to the UNFCCC[104] calculated the costs of meeting its 12 conditional Loss & Damage targets at US$177.7 million through 2030. It should be noted however that this cost estimate does not include any expenses related to post-event recovery, relocation, capacity or technology and only accounts for the most urgent institutional, procedural and preparatory activities related to addressing loss and damage.

Estimated Financial Needs 2025-2030

The following table seeks to provide a more realistic estimation of anticipated needs to address loss and damage from 2025-2030:

Vanuatu L&D Anticipated Financial Needs 2025-2030	USD
Anticipated Nationally Determined Contribution NDC L&D Needs	180,000,000
Anticipated Humanitarian, Disaster Response and Recovery Needs	2,500,000,000
Anticipated Needs to Address Non Economic Impacts in Situ	350,000,000
Anticipated Needs to Address Slow Onset Impacts In Situ	430,000,000
Anticipated Relocation/Retreat Finance Needs	780,000,000
Anticipated Needs to Address L&D Capacity Gaps	150,000,000
Anticipated Needs to Address L&D Technology Gaps	225,000,000
TOTAL USD	**4,615,000,000**

Technology Gaps and Needs

According to Vanuatu's Technology Needs Assessment[105] there are a range of technologies that will support ni-Vanuatu communities address loss and damage, including in the following sectors;

Agriculture

Emphasis was given to technologies with the potential to contribute to address the impacts of extreme events, prolonged dry periods and salinization. The TNA prioritises technology according to cost implications, and whether implementing a particular technology will contribute to adaptation, broad development and/or sector development objectives such as poverty reduction and gender mainstreaming.

Two of the top technologies priorities relevant to addressing loss and damage included;

1. Crop diversification and new varieties: a technology that entails the introduction of new cultivated species and improved varieties of crop, to address and respond to impacts including water and heat stress, water salinity, emergence of new pests and extreme events such as cyclones.

[104] https://unfccc.int/documents/578782
[105] https://tech-action.unepccc.org/wp-content/uploads/sites/2/2020/09/tna-adaptation-vanuatu.pdf

2. Farmer Field Schools: to strengthen the understanding of farmers about the ecological and climate processes that have affected the production of their crops and animals, through conducting field learning exercises such as field observations. Importantly FFS provide a platform for farmers to discuss and share knowledge related to addressing loss and damage in the agricultural context.

Water Security

1. Water Safety Plans: described collectively as a systematic and integrated approach to water supply management based on assessment and control of various factors that have damaged the safety of drinking water. The WSP approach allows for water suppliers to be flexible and responsive to changed input parameters
2. Flood Hazard Mapping: an exercise to define those coastal areas which are at risk of flooding under extreme conditions. As such, its primary objective is to anticipate and put in place response measures to address the impact of coastal flooding. The technology provides benefits for risk informed development planning, emergency management/response and raising awareness for flood hazard solutions.

Other technologies will be critical to enable Vanuatu's effort to address climate loss and damage, requiring targeted technology solutions that enhance resilience, disaster response, and recovery. The following technology gaps would need to fully align with community needs, respect indigenous knowledge, and foster local ownership for sustainable implementation.

1. **Enhanced Multi Hazard Early Warning Systems**: Advanced systems for monitoring and disseminating alerts for cyclones, floods, and atmospheric conditions to minimize risks to life and property.
2. **Climate-Resilient Infrastructure Technology**: Innovative materials and construction methods to rebuild create housing and public infrastructure that was lost or damaged due to extreme weather events and sea-level rise.
3. **Remote Sensing and Mapping Tools**: Use of satellite imagery and drones for damage assessment, land-use planning, and risk mapping in vulnerable areas.
4. **Water Management Technology**: Sustainable solutions including desalination units, and water purification to address prolonged droughts and contaminated water sources.
5. **Renewable Energy Solutions**: Solar, wind, and micro-hydro systems to provide energy independence and resilience during and after climate impacts occur.
6. **Data Management Platforms**: Systems to collect, store, and analyse climate and disaster-related data to inform policies and prioritize interventions.
7. **Habitat Rehabilitation**: Deployment of coral reef restoration technologies and wave break structures to mitigate storm surge and coastal erosion.
8. **Disaster-Resilient Communication Networks**: Satellite-based and decentralized communication systems to ensure connectivity throughout climate emergencies.
9. **Community-Focused Information Apps**: Mobile platforms that provide localized loss and damage education, resource-sharing, and real-time response coordination.

Capacity Gaps and Needs

While climate capacity has increased exponentially from 2010, there is a marked gap in knowledge, skills and capacities related to addressing loss and damage, largely due to the novel emergence of Loss & Damage as a stand-alone concept, and also due to the increasing severity and frequency of climate impacts.

The Vanuatu government has developed a Climate Change Strategy for the Ministry of Education and Training Skills Centres[106] in order to support mainstreaming climate change management into skills development activities in Vanuatu's technical and vocational education and training sector.

The Government of Vanuatu with support from the Australia Pacific Climate Partnership developed a report[107] on skills required to support a national and regional climate action workforce in the country, finding that "Vanuatu is experiencing an entrenched skills shortage in disciplines related to climate change. A range of factors impact on the capacity of qualified ni-Vanuatu workers to access climate change-related employment opportunities locally and regionally. This is despite considerable national and foreign investment in climate change training programs and related activities throughout the country."

The report suggested the following capacity recommendations relevant to loss and damage skills development;

- Integrate climate change-related content into all vocational training and assessment delivery, and primary, secondary and tertiary curricula.
- Strengthen the supply of climate skills with locally contextualised knowledge.
- Support the establishment of a national training centre of excellence for climate resilient technologies.
- Strengthen climate response leadership capacity for senior government officials at national and provincial levels.
- Strengthen delivery of scholarships (TVET, undergraduate, postgraduate) targeting skills for climate jobs.
- Support increased involvement of productive sector enterprises in climate response initiatives through skills, training and business development.

The key skills gaps included:

- Built Environment and Infrastructure, including construction and property services (including all aspects of commercial, civil and infrastructure construction), water and energy services, and transport and logistics (including maritime, road and air transport).
- Water, including the safe supply of water in the context of extreme weather and slow onset events
- Land Use and Coastal Protection- where there is an overwhelming convergence of climate, social and economic threats and hazards
- Energy – particularly related to renewable energy which is used in all aspects of addressing loss and damage
- Transport- including transport infrastructure (road, aviation and shipping) to ensure it is able to continue to meet the social and economic aspirations of the nation even during and after climate impacts
- Agriculture - already constrained by a combination of increasing frequency of extreme weather events, poor farming practices, and lack of land use planning
- Fisheries- related to damages to aquaculture facilities and fishing infrastructure
- Forestry- as there are documented "institutional weaknesses" hampering the availability and retention of adequate and qualified staff
- Tourism and Hospitality- in how to maintain economic activity after climate impacts
- Business and Finance- to improve knowledge and use of financial instruments, including insurance and cash transfer

[106] http://www.vanuatutvet.org.vu/wp-content/uploads/2019/11/Climate-Change-Strategy.pdf
[107] https://drive.google.com/file/d/1M3eNicksvngvcrx4wbPdMI7w8nfuBn95/edit

- Administration and Communication- including for climate response projects requiring administrative skills across a range of areas such as communications technology, video conferencing, and electronic filing and data management, English proficiency (written and oral) and competence with information technology applications
- Traditional Knowledge and Cross-cultural Competence- as traditional or kastom knowledge can be used to help communities and businesses understand and relate to climate impacts as well as to traditional practices (e.g. local agricultural practices and food production).
- Information Management- Given the multi-sectoral nature of climate response, the importance of sharing data and information is critical. Technical data collection and analysis using different types of information management systems (e.g., spatial data management and geological measuring systems) underpin loss and damage work.

The following table identifies providers of relevant climate loss and damage skills in Vanuatu

Provider	Climate Skills-related Delivery
Pacific Vocational Training Centre (Port Vila)	Certificate courses in engineering and information communications technology sector
Rural and remote PSET Providers	Certificate courses in business, construction, engineering, information communications, tourism and hospitality Non-formal short courses
Vanuatu Agriculture College[33]	Certificate courses in agriculture, forestry, horticulture and livestock
Vanuatu Institute of Technology (VIT)	Certificate courses in business, construction, climate change and disaster risk reduction, engineering, information communications, tourism and hospitality Non-formal short courses
Vanuatu National University	Bachelor and Master qualifications in economics, environment, social sciences, geography and town planning
University of the South Pacific (USP)[34]	Diploma, bachelor and postgraduate programs in agriculture, geography, environment, ocean and natural sciences
Pacific Centre for Environment and Sustainable Development (USP)[35]	Diploma and postgraduate programs in climate change
Pacific TAFE (USP)[36]	Certificate programs in coastal fisheries and aquaculture compliance, community development, project management and resilience (climate change and disaster risk reduction)
USP Vanuatu Campus	Online and face-to-face studies in certificate, bachelor, postgraduate courses

Australia Awards	Australia Award Scholarships and Australia Award Pacific Scholarships Australia for technical, bachelor and postgraduate study at regional and Australian tertiary institutions
Australia Pacific Training Coalition[37]	Trades and technology certificates in built environment, business, community services, education, engineering and hospitality and tourism Micro-credentials in business, information technology, personal services, business, tourism and hospitality
Other climate skills suppliers	World Vision Vanuatu: Inclusive water sanitation and hygiene, sustainable livelihoods and market linkages Care International Vanuatu: disaster risk reduction, climate change adaptation and food and livelihood security Live and Learn: environmental protection, disaster risk reduction and response, water sanitation and hygiene USAID: Climate Ready 'project preparation' short course

A report developed by the EU-PacTVET program on Vanuatu Training Needs and Gaps[108] identified the following skills gap areas to address climate loss and damage;

- Energy Efficient building designing and construction skills
- Solar PV systems, Hydropower and Wind O&M skills
- Building Construction Design Skills
- Food security and Recovery (Agriculture, Forestry, Fisheries Livestock)
- Aquaculture design and relocation management knowledge skills.
- Water security
- Weather Patterns & Climate Variability Analysis
- Soil and Nutrition Analysis
- Food Handling, Processing and Preservation
- Traditional Knowledge and social analysis

More general, transferrable and functional skill gaps for addressing loss and damage include:

- Communication
- Research Analysis and Reporting
- Public Speaking
- Planning, Organization, Administration and Management
- Creative and Innovative skills
- Coaching, Listening & Mentoring skills

[108] https://prdrse4all.spc.int/sites/default/files/vanuatu_0.pdf