VANUATU

VANUATU›S ENHANCED NATIONALLY DETERMINED CONTRIBUTIONS (NDC) 2020-2030

Enhancing and Fast-tracking Implementation of Vanuatu's Nationally Determined Contribution (NDC)

November 2020

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UNDP's work on climate change spans more than 140 countries and USD $3.7 billion in investments in climate change adaptation and mitigation measures since 2008. With the goal to foster ambitious progress towards resilient, zero-carbon development, UNDP has also supported the implementation of the Paris Agreement on Climate Change by working with countries on achieving their climate commitments or Nationally Determined Contributions (NDCs).

THE UNDP NDC SUPPORT PROGRAMME

The NDC Support Programme provides technical support for countries to pursue a "whole-of-society", integrated approach that strengthens national systems, facilitates climate action and increases access to finance for transformative sustainable development. The programme helps countries address these financial barriers by deploying a structured approach for scaling up sectoral investments and putting in place a transparent, enabling investment environment. Beyond direct country support, UNDP facilitates exchanges and learning opportunities on NDC implementation at the global and regional level by capitalizing on our close collaboration with the UNFCCC and other strategic partners. The Programme, which works in contribution to the NDC Partnership, is generously supported by the German Federal Minister for the Environment, Nature Conservation, and Nuclear Safety (BMU), the German Federal Ministry of Economic Cooperation and Development (BMZ), the European Union and the Government of Spain.

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ACRONYMS

AFOLU	Agriculture, forestry, and other land use
BAU	Business-as-usual
BRANTV	Barrier Removal for Achieving the National Energy Roadmap Targets of Vanuatu
CE	Circular economy
CCDRR	Climate change and disaster risk reduction
CMA	Meeting of the Parties to the Paris Agreement
CSO	Civil Society Organization
COP	Conference of the Parties
DoCC	Department of Climate Change
DoE	Department of Energy
DoF	Department of Forests
EPR	Extended producer responsibility
ETF	Enhanced transparency framework
EV	Electric vehicle
GDP	Gross Domestic Product
GHG	Greenhouse gases
GoV	Government of Vanuatu
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial processes and product use
IRENA	International Renewable Energy Agency
LPG	Liquefied petroleum gas
MALFFB	Ministry of Agriculture Livestock Fisheries Forests and Bio Security
MRV	Monitoring, reporting and verification
MoCC	Ministry of Climate Change Adaptation, Meteorology, Geo-Hazards, Energy, Environment and Disaster Management
NAB	National Advisory Board on Climate Change and Disaster Risk Reduction
NAMA	Nationally Appropriate Mitigation Action
NAP	National Adaptation Plan
NDC	Nationally Determined Contribution
NERM	National Energy Road Map
NGEF	National Green Energy Fund
NGO	Non-governmental organizations
NCD	Non-Communicable Disease
NDCs	Nationally Determined Contributions
NDC-IR	NDC Implementation Road Map
NDMO	National Disaster Management Office
NERM (IP)	National Energy Road Map (Implementation Plan)
NSDP	National Sustainable Development Plan
PA	Paris Agreement
PICs	Pacific Island Countries
PV	Solar photovoltaic
PWD	Public Works Department
PFE	Permanent forest estate
RBV	Reserve Bank of Vanuatu
REDD+	Reduced Emissions from Deforestation and Forest Degradation
RRA	Renewables Readiness Assessment
SDGs	Sustainable Development Goals
tCO_{2e}	Tons of carbon dioxide equivalent
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
URA	Utilities Regulatory Authority
VEMIS	Vanuatu Education Management Information System
VMGD	Vanuatu Meteorology and Geo-Hazards Department
VNSO	Vanuatu National Statistics Office
VREP	Vanuatu Rural Electrification Project
VUI	Vanuatu Utilities and Infrastructure Limited
WAM	With additional measures (enhanced NDC scenario)
WEM	With existing measures (NDC Scenario)
WM	With measures
WOM	Without measures (BAU Scenario)
WTE	Waste-to-energy

PREAMBLE

The Paris Agreement (PA) was adopted on 12 December 2015 at the 21st session of the Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC). The Republic of Vanuatu signed the PA on 22 April 2016 and deposited its instrument of ratification on 21 September 2016.

The agreement came into force on 4 November 2016. Its central aim is to strengthen the global response to the threat of climate change by holding the increase in the global average temperature this century to well below 2° C above pre-industrial levels and pursuing efforts to limit the temperature increase even further to 1.5° C. Additionally, it aims to strengthen the ability of countries to deal with the impacts of climate change.

The Government of Republic of Vanuatu is fully committed to effective and transparent implementation of the Agreement and submitted its declaration, which reads, in part:

"WHEREAS 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;

FURTHERMORE, the Government of the Republic of Vanuatu declares that, in light of best scientific information and assessment on climate change and its impacts, it considers the emission reduction obligations in Article 3 of the Kyoto Protocol, the Doha Amendment and the aforesaid Paris Agreement to be inadequate to prevent global temperature increase of 1.5 degrees Celsius above pre-Industrial levels and as a consequence, will have severe implications for our national interests..."

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 communicates its enhanced Nationally Determined Contributions under the agreement for the period 2020-2030. 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 Contributions (NDCs).

In that spirit, the Republic of Vanuatu presents its enhanced NDCs for the period 2020-2030 and calls on all Parties to increase their ambitions in line with the best available and most recent science and obligations under the Agreement.

Vanuatu's Enhanced Nationally Determined Contributions 2020-2030 (updated) was developed with support from the Climate Action Enhancement Package through the United Nations Development Programme (UNDP).

1. INTRODUCTION

1.1 BACKGROUND

Background

Country	Republic of Vanuatu		
SIDS/LDC Country Status	Yes		
National Communications	**Initial National Communication**	**Second National Communication**	**Third National Communication**
	Submitted on 30 Oct 1999	Submitted on 30 Aug 2016	Under finalization
First Nationally Determined Contribution	21 September 2016		

First NDC Key Indicators[1]

Reference year (base year, starting point)	2010
Target year	2030
Period	20 years (2010-2030)
Type of contribution (mitigation)	Sectoral commitment focused on a transition to renewable energy in the electricity generation subsector under energy generation.
Target level	To approach 100% renewable energy in the electricity subsector, contingent upon appropriate financial and technical support made available.
Greenhouse gas (GHG) reductions	100% below business-as-usual (BAU) emissions for electricity subsector and 30% for energy sector as a whole.
Sectors	Mainly electricity generation subsector, but with ancillary mitigation possible in forestry, agriculture, transport and energy efficiency sector-wide.
Gases	Carbon dioxide (CO_2)
Methodology	Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines

1 Government of Vanuatu (2016), First NDC submitted to the UNFCCC, available from: https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Vanuatu%20First/VANUATU%20%20INDC%20UNFCCC%20Submission.pdf

Planning process	Vanuatu's Intended Nationally Determined Contributions was aligned with: • Government's Priority Action Agenda Policy Objective 4.5 • Vanuatu National Energy Road Map (NERM 2013- 2020) • Scaling Up Renewable Energy in Low-Income Countries (SREP) Report • Rural electrification Nationally Appropriate Mitigation Action (NAMA) design document by UNDP Millennium Development Goal Carbon • Vanuatu's Renewables Readiness Assessment (RRA) report drafted by the International Renewable Energy Agency (IRENA) • Data and information provided by the Government of Vanuatu (GoV) and private and civil society organizations • Stakeholder consultation
Latest national GHG inventory (as per the draft TNC - National Inventory Report)[2]	
Inventory year	2015
Date of submission	Under finalization
Methodology used	IPCC-2006 Guidelines, Good Practice Guidance
Greenhouse gases (GHGs) covered	Carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O)
Indirect GHGs covered	Nil
Sectors covered	Energy (electricity generation, transportation, manufacturing and construction, Other sectors); AFOLU (agriculture, livestock, forest and land use); and waste(Solid Waste (municipal), wastewater)
Total net GHG emissions (excluding removals)	Total GHG emissions (CO_{2eq}): 610.204 Gg CO_{2e} Carbon dioxide (CO_2): 128.206 Gg CO_{2e} Methane (CH_4): 14.818 Gg CO_{2e} Nitrous oxide (N_2O): 0.253 Gg CO_{2e}
Total net sectoral GHG emissions (excluding removals)	Energy: 129.550 Gg CO_{2e} (21.23%) AFOLU: 443.380 Gg CO_{2e} (72.66%) Waste: 26.658 Gg CO_{2e} (6.11%)

1.2 OVERVIEW

This report, 'Vanuatu's Enhanced Nationally Determined Contributions (NDC) 2020-2030,' is the output of the technical assistance consultancy, Enhancing and Fast-tracking Implementation of Vanuatu's Nationally Determined Contribution (NDC) – Review and Updating Vanuatu's NDC (RFP MOCC/002/2020). The consultancy was awarded to Subbarao Consulting Services Ltd., New Zealand.

This document has been prepared under the guidance of the Vanuatu Ministry of Climate Change (MoCC) and has followed the information to facilitate clarity, transparency and understanding (ICTU) of the Nationally Determined Contributions (NDCs) through the review and assessment of relevant national policies and action plans. The key data references and documents assessed include:

- Vanuatu's first Nationally Determined Contributions (NDC);
- National Sustainable Development Plan: 2016-2030 (NSDP, also known as Vanuatu 2030: The People's Plan);

2 Vanuatu's Third National Communication to the UNFCCC - Draft (2020)

- Climate Change and Disaster Risk Reduction (CCDRR) Policy 2016-2030;
- Meteorology, Geological Hazards and Climate Change Act No. 25 of 2016 (Climate Change Act);
- NERM 2016-2030 and NERM-Implementation Plan (NERM-IP);
- NDC implementation road map;
- National Communications (NC1, NC2 and NC 3 (draft));
- Data and information provided by GoV line ministries and departments;
- Consultation with the public and private sectors and extensive stakeholder consultation.

Last, the assessment has been reviewed to align with the UNDP's quality assurance checklist under the Climate Promise Initiative for revising Nationally Determined Contributions (NDCs).[3]

The first section of this report provides an overview of Vanuatu's national circumstances, including its geographic profile, climate and climate change impacts, environment and natural resources, socio-economic characteristics (population, health and education), economy and key economic sectors (energy, transport and infrastructure (roads, aviation and shipping), industry, tourism, agriculture, fisheries and aquaculture.

The second section highlights the Republic of Vanuatu's long-term vision for climate change and its aspirations along with key policy perspectives. Those include:

- Vanuatu 2030: The Peoples Plan;
- Vanuatu's Climate Change and Disaster Risk Reduction Policy (CCDRR) 2016-2030;
- Climate Change Act;'
- The Republic of Vanuatu's National Energy Road Map (NERM) 2016-2030 and Implementation Road Map;
- Vanuatu's current Nationally Determined Contribution (NDC) and Implementation Road Map;
- IRENA RRA;
- National Green Energy Fund (NGEF);
- Renewable Energy Electrification Master Plan for Vanuatu;
- Vanuatu National Forest Policy (2013-2023); and,
- Reduced Emissions from Deforestation and Forest Degradation (REDD+) Programme.

The third section reviews the assessment of GHG emission sectors in Vanuatu as defined by the IPCC. The assessment includes Vanuatu's GHG emission profile as reported under the first, second and draft third national GHG inventory reports.

The fourth section includes the sectoral GHG mitigation potential assessment for each IPCC sector and subsectors applicable to Vanuatu. The key sectors and subsectors are:

- Energy sector: energy industry or electricity generation;
- Transport: road transport, aviation and water-borne navigation;

3 https://www.ndcs.undp.org/content/dam/LECB/docs/pubs-reports/undp-ndcsp-climate-promise-quality-assurance-checklist.pdf?download

- Manufacturing industries and construction;
- Other sectors: residential, commercial and others;
- IPPU;
- AFOLU; and,
- Waste: – solid waste (municipal) and wastewater.

The GHG mitigation potential assessment also includes the mitigation measures identified in the existing NDC and additional potential mitigation measures recommended to enhance NDC ambitions. The GHG mitigation assessment also provides GHG emission projections under different scenarios:

1. Business-as-usual (BAU) scenario or 'without measures' (WOM): Assessment based on what might happen if Vanuatu takes (or has taken) no action (WOM);

2. NDC scenario or 'with existing measures' (WEM): Assessment based on what might be achieved with the actions that Vanuatu is committed to take under the existing NDC (WEM), sometimes simply known as 'with measures' (WM)); and,

3. Enhanced NDC scenario or 'with additional measures' (WAM): Assessment based on additional measures identified and to be included as enhanced NDC actions, e.g., what else Vanuatu could do to further enhance its climate change-related ambitions (WAM).

These scenarios have been assessed using the same set of historical data and relevant data extrapolation and assumptions based on growth in gross domestic product (GDP), population, electrification, transport and technology uptake. (Please refer to the emissions calculation sheet and model for the data and graph reference.)

The fifth section includes a comprehensive list of additional potential mitigation measures identified for each of the relevant IPCC sectors and subsectors, along with potential GHG emissions reduction and emissions scenarios under enhanced NDCs, or WAM.

In addition to the NDC enhancement approach defined by UNFCCC, the GoV has undertaken a metabolic analysis of its economy and economic sectors to explore circular economy (CE) opportunities. A metabolic assessment was conducted to define a resource-efficient and low-carbon future for Vanuatu. The metabolic assessment found that average material uses and per capita GHG emissions in Vanuatu are low relative to global averages. Vanuatu's existing consumption-based resource footprint is 58 percent, which is relatively circular. That is, the country already relies on secondary or renewable materials and energy sources for 58 percent of the materials used. The remaining 42 percent is not circular and can be described as following a linear 'take-make-waste' trajectory. Those materials are mostly of foreign origin and are incompatible with the country's development ambitions because they create waste disposal problems. They contribute to the deterioration of natural assets by polluting soils, surface waters and marine environments. The CE analysis identified some of the opportunities that contribute to GHG mitigation and NDC objectives, as the circular economy aims to avoid waste and reduce the extraction of primary resources (the analysis is annexed to this report). Some of the key CE actions, or CE strategies, identified by the metabolic assessment have been included as additional enhanced NDC actions.

The sixth section of the report covers Vanuatu's monitoring, reporting and verification (MRV) system. The integrated MRV tool that the country uses makes it possible to routinely compile data and information that help to track progress towards the realization of the NDC targets, including the Sustainable Development Goals (SDGs). The integrated MRV framework also aligns well with reporting requirements under the National Communications (NC) and Biannual Update Reports (BUR). To strengthen the NDC implementation process, stakeholder capacity-building to implement the mitigation contributions will also be supported.

The last section of this report presents the means by which climate actions and NDCs can be implemented in Vanuatu. This addresses primarily the institutional arrangements and structures in place for NDC implementation, MRV and execution of government policies, programmes and actions, including the enhanced NDCs. The institutional arrangements also highlight the role of the public and private sectors, civil society, and development partners.

The draft NDC report, along with the supporting analysis and Excel work sheets were shared with internal and external stakeholders, including relevant line ministries/departments (the Department of Energy (DoE), Department of Environmental Protection and Conservation, Department of Forests (DoF), Department of Fisheries, Department of Livestock, Department of Biosecurity, Department of Strategic Planning and Aid Coordination, Department of Women's Affairs, the private sector and other development partners) for their input, review and comments. Additionally, internal and external quality assurance review has been conducted as per the UNDP's Quality Assurance Checklist Assessment for Revising Nationally Determined Contributions, which is annexed to the report.

A national-level stakeholder consultation was conducted to present the draft NDC update report and key observations and findings prior to finalizing the report. The final report was endorsed by Vanuatu's National Advisory Board on Climate Change and Disaster Risk Reduction (NAB) and the Council of Ministers.

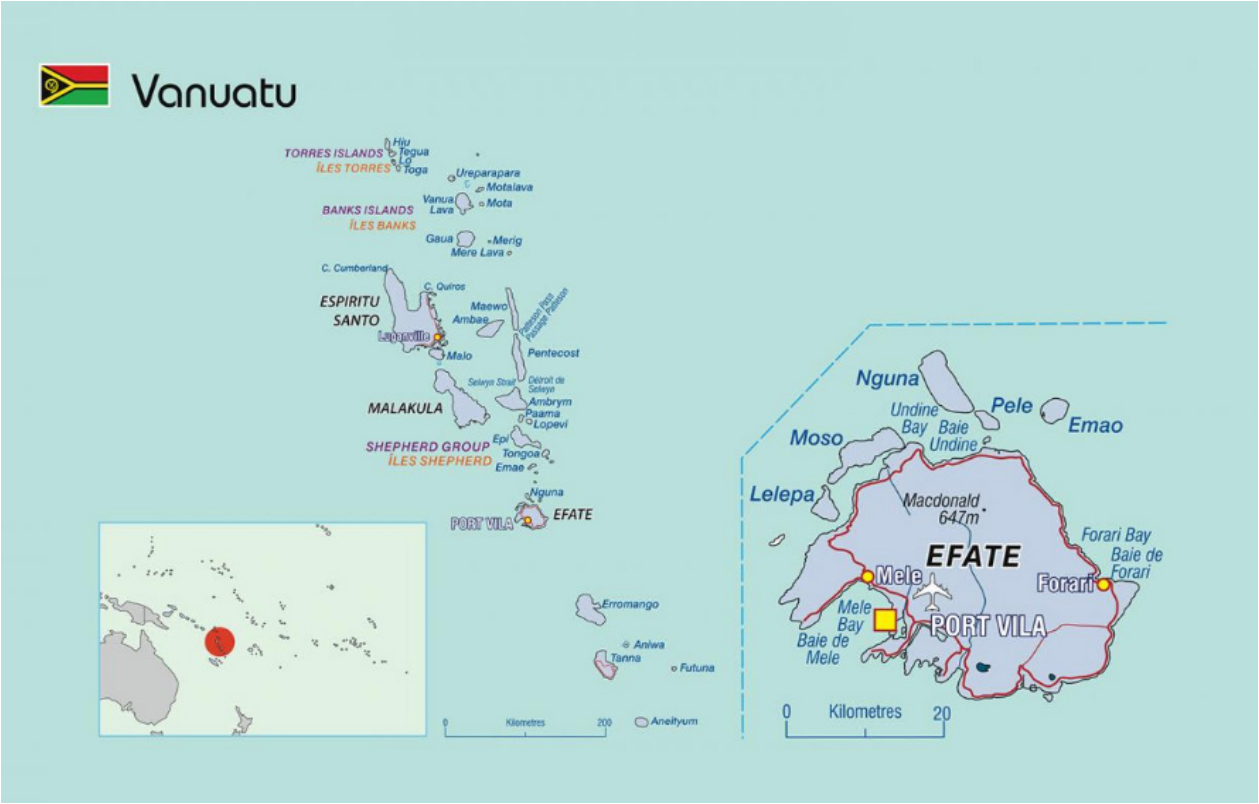
2. NATIONAL CIRCUMSTANCES

2.1 GEOGRAPHIC PROFILE

The Republic of Vanuatu is an island nation located in the western Pacific Ocean. This archipelago of over 80 islands, which extends 1,300 kilometers from north to south, is of volcanic origin. It is some 1,750 km east of northern Australia, 500 km northeast of New Caledonia, west of Fiji and southeast of the Solomon Islands.

Vanuatu is located between latitudes 12° to 23° south and longitudes 166° to 173° east. Vanuatu's terrain is mostly mountainous, with narrow coastal plains. It comprises 83 islands, of which 65 are inhabited, with total land area of 12,336 km2 and a maritime exclusive economic zone of 680,000 km2. The largest island is Espiritu Santo. Efate Island is home to the capital, Port Vila and Vanuatu's national government. From largest to smallest, the islands are Espiritu Santo, Malekula, Efate, Erromango, Ambrym, Tanna, Pentecost, Epi, Ambae (or Aoba), Vanua Lava, Gaua, Maewo, Malo, and Anatom (or Aneityum). The two largest islands, Espiritu Santo and Malekula, make up nearly 50 percent of the total land mass. Larger islands are characterized by rugged volcanic peaks and tropical rainforests. The ighest peak, Mount Tabwemasana on Espiritu Santo, is 1877 m above mean sea level and the total coastline is about 2,528 km long.

Figure 1: Geographical map of Vanuatu



Vanuatu is located geographically in what are known as the Ring of Fire and the Pacific cyclone belt. This is a seismically and volcanically active region and Vanuatu has high exposure to geologic hazards, including volcanic eruptions, earthquakes, tsunamis and landslides. Almost 81 percent of its landmass and 76 percent of its population are exposed to two or more potential hazards, including volcanic eruptions, cyclones, earthquakes, droughts, tsunamis, storm surges, coastal and river flooding, and landslides.

2.2 CLIMATE AND CLIMATE CHANGE IMPACTS

Vanuatu is situated in a tropical maritime climate with characteristic uniform temperature, high humidity and variable rainfall. The tropical climate is moderated by southeast trade winds that occur from May to October. The two main seasons are hot and wet from November to April and cool and dry from May to October. As an equatorial country, Vanuatu's temperature is relatively uniform, with daily temperatures throughout the year ranging from 20°C to 30°C. Temperatures

in the warmest months (January- February) are about 4°C higher than those in the coolest months (July-August).

In the coastal areas, the daily temperature average is 26°C in the hot season, with an average maximum of 30°C and an average minimum of 24°C. Extreme night-time minimum temperatures in some coastal areas may reach 13°C. Port Vila, the capital on the west coast of Efate, has an average temperature of 25°C, with August averaging 23°C and February averaging 27°C. The water temperature ranges from 22°C in the cooler season to 28°C in the hot season.

Vanuatu has a long rainy season, with significant rainfall occurring nearly every month. The country's rainfall is strongly influenced by the position and strength of the South Pacific Convergence Zone. During summer, the zone intensifies and moves further south, bringing the higher rainfall of the wet season. Rainfall in Vanuatu varies greatly year-to-year, due primarily to the influence of the El Niño-Southern Oscillation.

The predominant wind flows in most seasons are the trade winds, which blow from east to southeast at about 5 knots. Wind flows during the hot season (November to April) are generally light and variable. In the cool season, from May to October, the southeast trade wind flows become persistent, averaging 10 knots. Strong marine wind warnings over open waters are common in the cool season with speeds up to 25 knots. However, tropical cyclones and depressions are also common and can be responsible for high and destructive winds in the hot season. Vanuatu's latitude places it in the path of tropical cyclones, and it is subject to El Niño and La Niña cycles, which, respectively, increase the risks of droughts and floods. Typically, two or three cyclones hit Vanuatu's total area (land and sea) over a cyclone season, with the greatest frequency in January and February. On average, Vanuatu and its marginal seas are common routes for some 20 to 30 cyclones per decade; three to five cause severe damage. Natural hazards affecting Vanuatu include tropical cyclones, volcanism (which causes earthquakes) and occasional tsunamis. Future climate change and sea-level rise threaten to exacerbate the risks posed by tropical cyclones, coastal and river flooding, coastal erosion, heavy rainfall events, and droughts.

2.3 ENVIRONMENT AND NATURAL RESOURCES

Vanuatu's land area totals approximately 12,336 km2. Almost 74 percent of that area is covered by natural vegetation, with more than 36.1 percent (440,000 hectares) covered by tropical forest. Vanuatu does not classify land by function or land capability classes, nor does it have a legally defined permanent forest estate (PFE). All lands, including forest lands, are customarily owned; that is, by individuals or communities (clans or families). Government-owned land with forest does not exist. However, the forests are important to rural communities as they are one of the communities' main sources of cash income. The quality of natural forests in terms of commercial forestry is low. The forests provide a wide range of products for the subsistence lifestyle of most ni-Vanuatu.

The 1990-1993 National Forest Inventory found that around 74 percent of Vanuatu was covered by woody vegetation, half of which was closed forests and the remainder, discontinuous scrub and thicket. Of that, only 10 percent was primary forest. The estimated commercially exploitable forest was determined to be approximately 35 percent of forest cover. However, this situation is changing fast. Vanuatu is using more forests than are being planted and some of the customary landowners are developing their logged forest

areas for other activities, such as cattle rearing or real estate in coastland lowland areas of Efate and east Santo[4]. By 2006, some 4,800 hectares were covered with planted forests; approximately 3 percent of the high to mid forest (about 6,000 ha) and 0.7 percent of the low forest (about 1,400 ha) are in protected areas.

Vanuatu has some 108 known species of amphibians, birds, mammals and reptiles. Of those, 21.3 percent are endemic (they exist in no other country) and 13 percent are threatened. Vanuatu is also home to at least 870 species of vascular plants, of which 17.2 percent are endemic. There are around 1,000 vascular plants, of which 150 are endemic, and 700 species of bryophytes, including many invertebrate species (including butterfly, bees, flies, ants and termites) The coconut crab is one of Vanuatu's best-known invertebrates. Vanuatu hosts 121 bird species, some of which are rare or vulnerable, and around 30 species of reptiles and amphibians.

The region is rich in sea life, with more than 4,000 species of marine molluscs. The giant East African land snail arrived only in the 1970s, but has already spread from the Port Vila region to much of the rest of the country. There are three or, possibly, four adult saltwater crocodiles living in Vanuatu's mangroves with no current breeding population.

Coral reef systems fringe most islands in Vanuatu. The Reef Islands, also called Rowa, are a cluster of coral cays between Mota Lave and Ureparapara, in northern Vanuatu. They are important sources of economic and subsistence resources and a drawing card for the important tourism sector, while they also protect adjacent coastlines from extreme sea events. Mangroves are also an important part of the Vanuatu's ecosystem, with sea grass beds and other near-shore marine ecosystems. Mangrove ecosystem services include subsistence/commercial and recreational fishing, wood, tourism, bioremediation, sediment trap, protection against waves, and carbon sequestration.

2.4 SOCIO-ECONOMIC CHARACTERISTICS

2.4.1 POPULATION

According to the most recent (mini-) census undertaken in 2016, Vanuatu's population totalled 272, 459 compared to 234,023 in the 2009 census. Seventy-five percent of the population is based in rural areas. Shefa and Sanma provinces, home to Vanuatu's urban centres of Port Vila and Luganville, respectively, have the largest populations. The country's growth rate is among the highest in the Pacific region. This is more pronounced in the urban settings of Port Vila and Luganville. Vanuatu has a young population, with approximately 50 percent under 40 years of age. The population is close to a sex ratio of 1:1, although projections indicate that that ratio will reach 1:1 by 2050.

Table 1: Vanuatu's population (2016 mini-census)

Place of residence	Population	Male	Female	Number of households	Average annual population growth rate (%)	Population density (number of people/km^2)
Vanuatu	272,459	138,256	134,194	55,527	2.3	22
Urban	67,749	34,506	33,243	14,048	2.6	-
Rural	204,710	103,759	100,951	41,479	2.3	-

4 http://www.fao.org/forestry/18248-0b2552633ff6923bf49424c42a79c8740.pdf

2.4.2 HEALTH

Life expectancy in Vanuatu has increased and now stands at 69.6 and 72.7 years for males and females, respectively (Vanuatu National Statistics Office (VNSO), 2009). However, the country faces the dual challenges of communicable disease and the rapidly growing incidence of non-communicable disease (NCD), notably diabetes and hypertension. People are living longer, but often with the burden of chronic illness and disability.

People at all levels of the health system and in the community are concerned about the impacts of NCDs in terms of premature death and increasing levels of disability, including stroke, amputation, blindness and mental illness. For the health system, the costs of managing the NCD crisis are huge and growing daily. While there are fewer malaria cases, Vanuatu still has troubling levels of other communicable diseases, such as tuberculosis and sexually transmitted infections. The challenge is to maintain the significant gains made as resistant strains of disease emerge, population mobility increases and development partner support decreases. And although 90 percent of people now have improved water supply, almost half the population lacks proper sanitation. Along with poor hygiene, this helps spread infectious diseases such as tuberculosis, acute respiratory infections, diarrhea and skin diseases.

Vanuatu still lags in terms of maternal and child health. Although nine out of 10 women giving birth now have skilled birth attendants, too many women still die in childbirth. Numbers of maternal deaths have actually increased over the past three years, although this may be due to improved reporting.

2.4.3 EDUCATION

Vanuatu operates a bilingual education system, with English and French taught to students throughout the country in early childhood education (ECCE), primary and secondary schools. Table 2 below shows the number of and types of schools.

Table 2: Total number of schools in Vanuatu by school type, 2016 – 2018

Education sector level	2016	2017	2018
Early childhood education	566	520	838
Primary schools	438	436	455
Secondary school	93	93	104
Post-school education and training	7	7	7

The number of children enrolled in ECCE centres throughout Vanuatu rose by 4.9 percent in 2018 compared to 2017. At the primary level, the number of students rose by 7.7 percent in 2018 compared to 2017 and by 3.9 percent at the secondary level in 2018 compared to 2017. The number of teachers in ECCE and primary schools also rose in 2018. However, the Ministry of Education and Training is still entering the number of ECCE, primary and secondary school teachers, by qualification, in the management information system. It is expected that all teachers will be recorded in the system by 2019.

2.5 ECONOMY

Vanuatu is traditionally known for its strong cultural heritage tradition activities and subsistence farming. The four mainstays of Vanuatu's economy are agriculture, tourism, offshore financial services and cattle raising. Exports include copra, kava, beef, cocoa and timber, and imports include machinery and equipment, foodstuffs, and fuel.

In 2017, Vanuatu's economy grew by 4.4 percent, with strong performance over the last three years. The economy was projected to grow by 3.4 percent in 2018 over 2017 growth levels. Growth was

primarily driven by construction activities related to ongoing infrastructure development projects and reconstruction projects from tropical cyclone Pam (VNSO 2019; RBV 2018).

The 4.4 percent GDP growth was led primarily by industry, followed by services and agriculture. Although industry has continued to perform well, based on strong growth in the two prior years, it contributes less to GDP growth than services and agriculture. In terms of contribution by industry, services represent the largest share (65 percent), contributing to positive growth of 1.8 per cent in 2017, followed by agriculture fishing and forestry.

2.6 ECONOMIC SECTORS

2.6.1 ENERGY

The GoV's principal objectives for the energy sector are to reduce dependency on fossil fuels, encourage the use of renewable sources and increase energy security while managing demand through energy efficiency measures. Under the NERM 2016–2030, the government's targets are to achieve 100 percent electricity generation from renewable sources and provide electricity to all households by 2030. Biomass and imported petroleum products are Vanuatu's main energy sources. Biomass is used primarily for residential purposes, such as cooking and crop drying. However, petroleum products are important inputs into major economic sectors, including electricity, industry, tourism, transportation, fishing and agriculture. Vanuatu's primary needs are mainly met by imported petroleum. Petroleum consumption has increased substantially, at an average annual rate of 6 percent in recent years. Most electricity is derived from diesel (71 percent) and renewable energy (29 percent). Renewable sources currently used include hydro, solar, wind and biofuel.

2.6.2 TRANSPORT AND INFRASTRUCTURE

Vanuatu's geographic and demographic structure pose obstacles to development efforts. The population is scattered over approximately 80 widely distributed islands, 64 of which are populated (2009 national census), making travel difficult and costly. The distance from the southernmost to northernmost islands is over 800 km. Vanuatu's geography also complicates and increases the cost of building infrastructure. With population clusters so small, it is difficult to justify such projects both economically and financially. The logistical challenges of moving large construction equipment from island to island deter contractors and increase prices. Once built, limited capacity and resources to maintain infrastructure leads to asset deterioration. Consequently, significant gaps exist in providing and operating physical infrastructure, particularly in poor and remote rural areas.

2.6.3 ROADS

Vanuatu is estimated to have 1,800 km of roads. Of these, 234 km are sealed and 1,142 km are gravel. The remaining 400km are simple earth roads (Vanuatu In-country Science Programme 2014). The Port Vila and Luganville urban areas account for the majority of sealed roads, and the recently improved Efate ring road and Santo East Coast Road represent the first extensive sealed roads outside the two main towns. On most islands, other than Efate, Santo, and Tanna, road links have developed largely to service remote communities' administrative and economic needs. In many locations, where separate stretches of road on a particular island are still not connected.

2.6.4 AVIATION

There are 29 airfields in Vanuatu. Airports Vanuatu Limited operates the three main airports at Port Vila (Bauerfield), Luganville (Pekoa) and Tanna (Whitegrass). The other 26 are regulated by the Civil Aviation Authority of Vanuatu and run by the Public Works Department (PWD). The Bauerfield airport is Vanuatu's principal international gateway and handles around 250,000 international passengers per year. The runway is long enough to accommodate most commercial aircraft, although it imposes weight restrictions for some (for example, Boeing 767 and 777 and Airbus A330).

2.6.5 SHIPPING

With its population spread over 64 populated islands, Vanuatu depends on water transport. However, limited infrastructure restricts cargo and passenger movement. Inadequate wharves and jetties restrict vessels from calling at many destinations in all but ideal weather conditions, including the main jetty for Isangel in Tanna. The principal wharves are in Port Vila and Luganville. The wharves on Malekula and Tanna are adequate for conventional ships, but not in all sea conditions. The majority of calls to outer islands are made directly to a beach or by lighters.

2.6.6 INDUSTRY

Vanuatu's manufacturing sector is very small and is driven by just a few players, based mainly in Luganville and Port Vila. According to estimates, manufacturing value-added totals just 3.8 percent of Vanuatu's GDP (National Industrial Development Strategy, 2018).

2.6.7 TOURISM

Tourism is a mainstay of the Vanuatu economy. The country recently embarked on a "greener" path as outlined its National Sustainable Tourism Policy. The policy seeks to strike a balance between economic viability, social acceptability and environmental responsibility. It also focuses on enhancing the resilience of Vanuatu's cultural, social and ecological systems in the face of changes, complexity and uncertainty. Tropical Cyclone Pam in 2015 slowed growth significantly, but the tourism sector is gradually recovering.

2.6.8 AGRICULTURE

Subsistence farming represents more than 75 percent of agriculture in Vanuatu. This type of farming focuses primarily on root crops such as taro, yam, cassava and sweet potato. In addition, it reflects local consumption and serves cultural purposes. Subsistence farming is highly dependent on rain for irrigation and basic tools are used. Small-scale, semi-commercial farming is also practiced around the urban areas. The crops involve mainly green leafy vegetables, local island cabbage, Chinese cabbage, capsicum, eggplants, spices and herbs. In general, the agricultural sector accounts for more than 75 percent of exports. The most important agricultural product is copra, which is the dried meat or dried kernel of the coconut used to extract coconut oil. Coconut, cocoa, kava and coffee are the main cash crops. The production of beef and timber has grown in importance for the economy. Coconut oil is also used as fuel, a trend with major implications for the cultivation and sale of locally grown coconuts.

According to the Reserve Bank of Vanuatu's Economic Review (2018), kava exports contributed approximately 45.1 percent of total exports (estimated at US$4.3 million), followed by copra at 19.9 percent (estimated at $2 million), coconut oil at 9.3 percent (estimated at $900,000), cocoa at 8.6 percent (estimated at $800,000 million), other products at 11.1 percent (estimated at $1 million) and the remainder from other exports. In line with domestic production, kava, cocoa, beef and coffee exports rose, despite a decline in other commodities.

The impact of natural disasters, including tropical cyclones and Ambae volcanic eruptions, on the production of kava, copra, root crops and vegetables on Vanuatu's northern islands led to weaker-than-expected growth in the agriculture sector in 2018.

2.6.9 FISHERIES AND AQUACULTURE

Fisheries' contribution to 2012 GDP was estimated at $5.5 million, or 0.7 percent of national GDP. Fisheries export value in 2015 was estimated at $100 million and import value at $5.1 million. Annual per capita consumption was 32.1 kg in 2013. Compared to other Pacific Island countries, Vanuatu's inshore marine areas are limited. Inner reef areas include only narrow fringing reefs and the area covered by mangroves is quite small.

Vanuatu has industrial-scale distant water fisheries operating in the Atlantic Ocean, the Indian Ocean and the eastern Pacific Ocean, in addition to in its own exclusive economic zone and surrounding area, with at least 96 longlines, three purse seiners and two active fishing trawlers in 2015[5]. However, total distant-water catch declined significantly to about 77 tons in 2016, after peaking at almost 144,000 tons in 2006, in addition to 43,000 tons taken in the western central Pacific fishing area where Vanuatu is located. Coastal fishing is conducted primarily for subsistence and for sale at local markets. Subsistence fishing activities include coastal line and net fishing for demersal and small pelagic reef and lagoon fish, as well as reef gleaning and collection of shellfish and other invertebrates.

In 2016, the aquaculture sector employed 34 women and 173 men. An estimated 38 percent of people engaged in marine fishing and subsistence fisheries were women. In addition, some coastal fisheries are export oriented, including trochus, beech-de-mer, and aquarium fish. Vanuatu has had an aquarium fishery for the last 15 years. In 2015, the country exported ornamental fish valued at $224,000 and corals and shells valued at $92,000. Aquaculture efforts in Vanuatu have included attempts at raising oyster, rabbitfish, freshwater shrimp, trochus, green snail and tilapia.

5 http://www.fao.org/fishery/xml/facp/155/en

3. VANUATU'S LONG-TERM VISION ON CLIMATE CHANGE - POLICY PERSPECTIVE

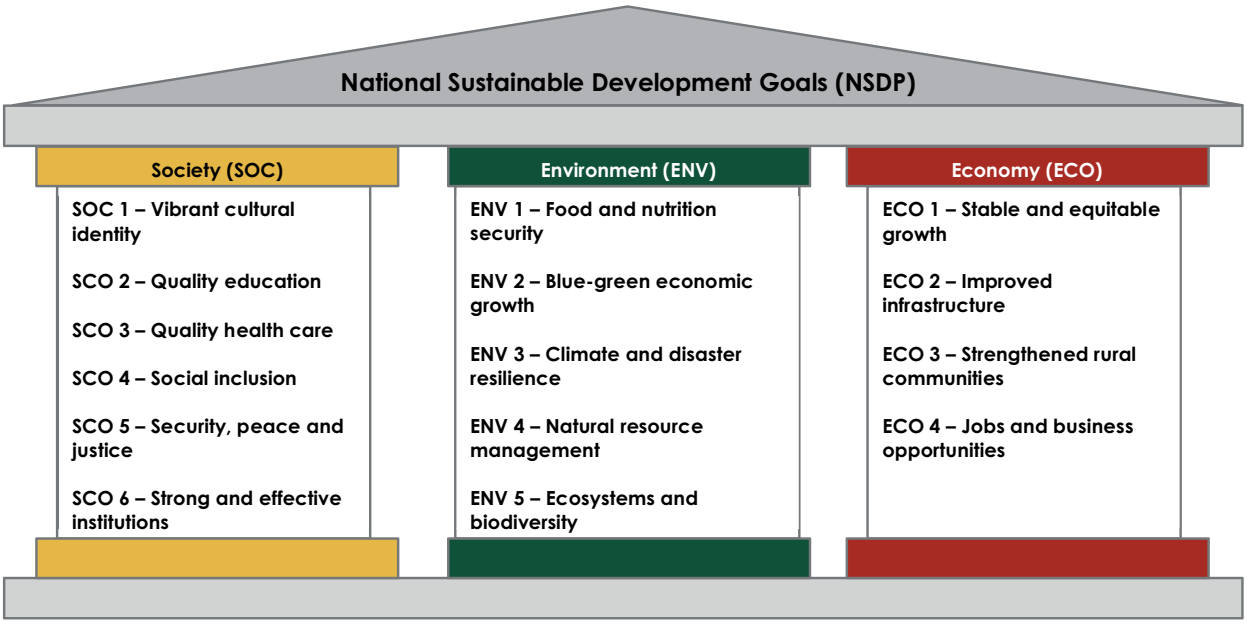
The Republic of Vanuatu's long-term vision on climate change and its aspirations are an integral part of the fundamental duties defined under its constitution - *"To protect the Republic of Vanuatu and to safeguard the national wealth, resources and environment in the interests of the present generation and of future generations"* - and are guided by its National Vision - *"A stable, sustainable and prosperous Vanuatu"* – outlined in the NSDP for 2016 to 2030, also known as Vanuatu 2030: The People's Plan.

3.1 NATIONAL SUSTAINABLE DEVELOPMENT PLAN (NSDP): 2016-2030

Vanuatu 2030: The People's Plan charts Vanuatu's long-term vision and serves as the highest-level overarching policy framework for achieving a stable, sustainable and prosperous Vanuatu by 2030. The collective developmental aspirations under the NSDP include:

- A vibrant cultural identity underpinning a peaceful, just and inclusive society;
- Supported by responsive and capable state institutions delivering quality public services, including health and education, to all citizens;
- Maintaining a pristine natural environment on land and at sea that serves our food, cultural, economic and ecological needs;
- With enhanced resilience and adaptive capacity to climate change and natural disasters;
- And, a stable economy based on equitable, sustainable growth that creates jobs and income-earning opportunities accessible to all people in rural and urban areas.

Figure 2: National Sustainable Development Goals (NSDP) 2016-2030



These collective aspirations are to be delivered through the 15 national SDGs, reflecting the priorities expressed by the ni-Vanuatu people through a programme of national consultation. The NSDP: 2016-2030 is based on three pillars - society, environment and the economy - and each pillar is further divided into goals, which in turn are broken down into a series of policy objectives. The three NSDP pillars incorporate 98 policy objectives across 15 goals.

The Republic of Vanuatu's long-term climate action vision is governed by the Vanuatu CCDRR Policy 2016-2030[6] and the Climate Change Act.

3.2 VANUATU'S CLIMATE CHANGE AND DISASTER RISK REDUCTION POLICY 2016-2030[7]

The CCDRR policy promotes good governance and establishes priorities and strategies for future climate actions. It also aims to deliver better information and improved assessments of climate change impacts and disaster risks, set key strategies, and transparently communicate to stakeholders, including communities, international donors and agencies. The policy builds on existing systems and the country's cultural heritage to improve Vanuatu's resilience, incorporates project and outcomes monitoring and evaluation, and captures experiences and lessons learned to inform planning and good practices.

The policy applies six principles: accountability; sustainability; equity; community focus; collaboration; and, innovation. It emphasizes coordination and communication at all levels of government and across sectors and communities for effective implementation and engages provincial authorities, area councils and groups in society, especially women and vulnerable groups (including the elderly, disabled and youth) in planning, decision-making and community action, in line with decentralization.

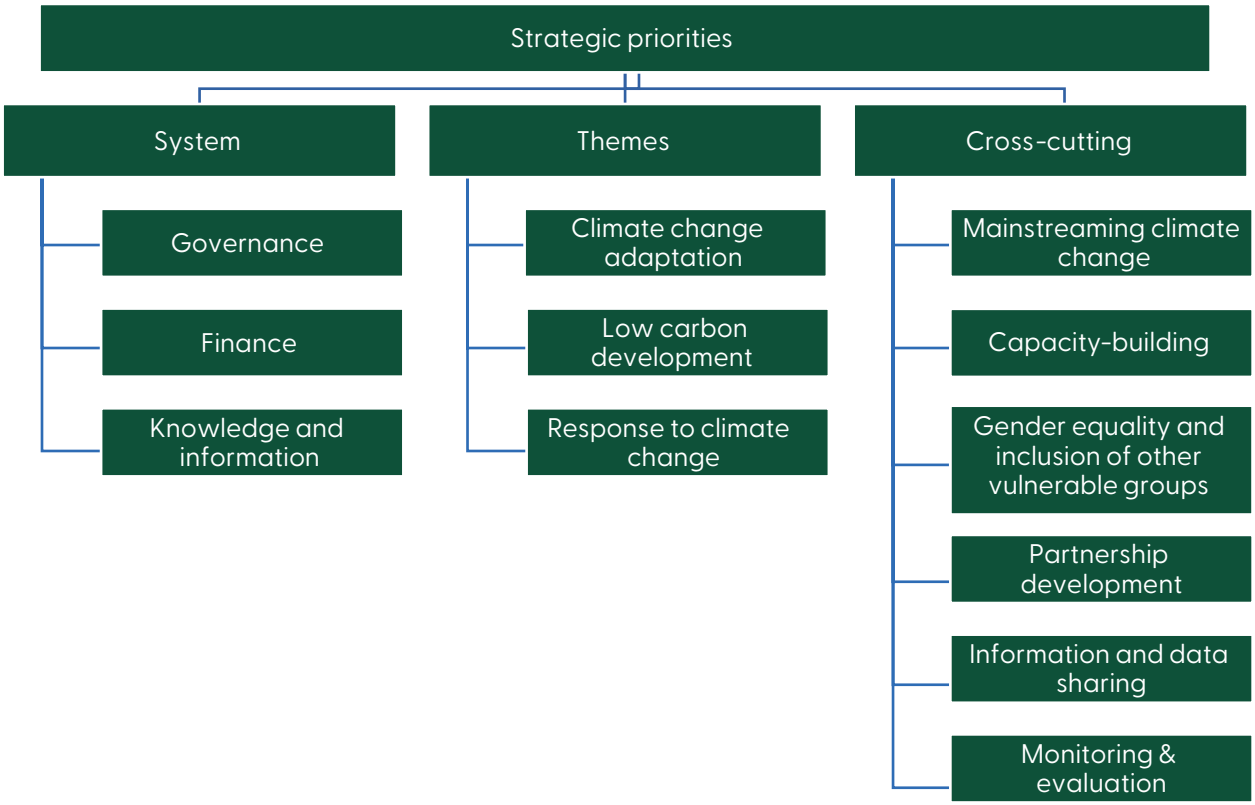
The GoV is committed to six key priorities to guide the country's climate change and disaster risk reduction efforts. These priorities fall into two categories: systems and themes. Systems include governance, finance, knowledge and information, while themes include climate change adaptation and disaster risk reduction, low-carbon development, and response and recovery. A number of cross-cutting issues have also been considered in developing this policy and will be applied during implementation, including social and gender inclusion, capacity-building, multi-hazard approaches, partnerships and mainstreaming into the business of a broad range of agencies and sectors.

The policy includes high-level strategies and detailed actions, lead and support agencies, resources, and timelines will be further developed for implementation.

6 Vanuatu 2030 – The People's plan - National Sustainable Development Plan 2016 to 2030 (2016), available from: https://www.gov.vu/index.php/resources/vanuatu-2030

7 Government of the Republic of Vanuatu (2015), Vanuatu Climate Change and Disaster Risk Reduction Policy 2016-2030, available from: https://docc.gov.vu/images/publications/Vanuatu%20Climate%20Change%20and%20Disaster%20Risk%20Reduction%20Policies%202016-2030.pdf

Figure 3: Vanuatu's strategic climate change priorities and actions



3.3 THE METEOROLOGY, GEOLOGICAL HAZARDS AND CLIMATE CHANGE ACT NO. 25 OF 2016 (CLIMATE CHANGE ACT OF 2016)

The Climate Change Act sets out governance and administrative provisions and provides for transparency. It also outlines roles and responsibilities for meteorology, geological hazards and climate change and for related purposes. The Act's key objectives are to:

(a) ensure that high-quality services are provided in relation to weather, climate, flood forecasting and geological hazards in Vanuatu;

(b) promote capacities of governments, communities and organizations to understand and respond to risks arising from weather events, climate change and geological hazards;

(c) specifically address the needs of shop and aircraft operators and tourists to access all necessary weather forecasts, bulletins, alerts, warnings and information concerning geological hazards that may impact the safety of their operations or activities;

(d) facilitate the use and application within Vanuatu of relevant information, forecasts, bulletins and warnings generated and disseminated to and by local, regional and international bodies; and,

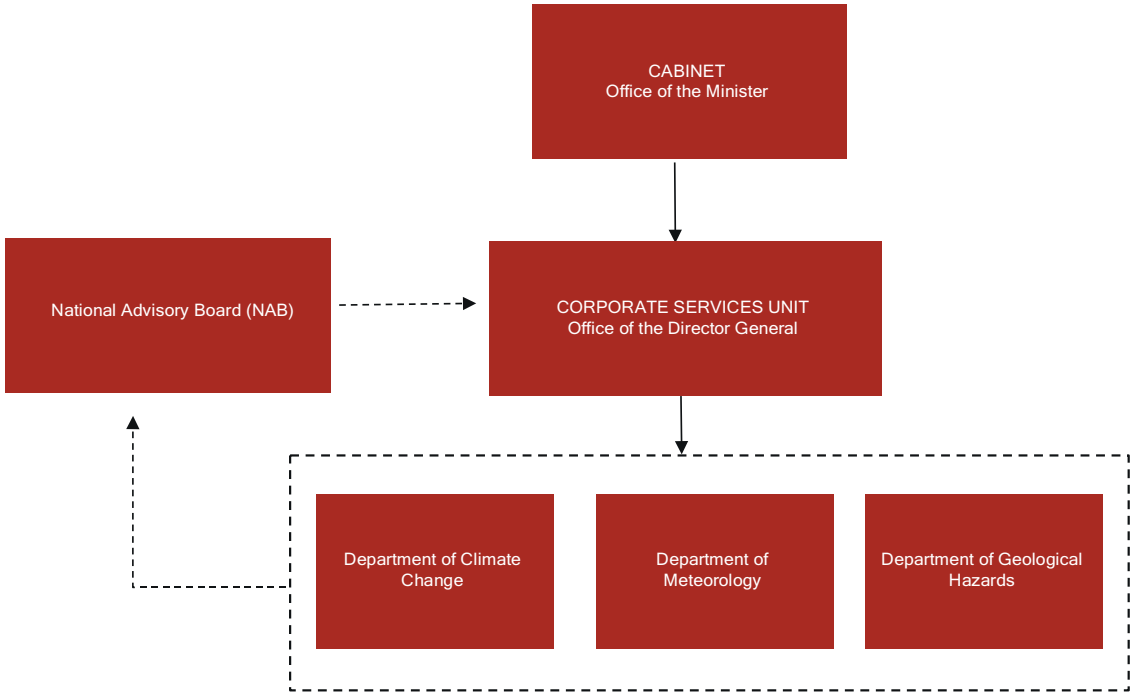
(e) ensure that the government and the public are informed of matters related to weather, climate and geological hazards and can make effective use of such information and data and respond to warnings and alerts about such events to protect the environment and the safety and welfare of the community.

The Climate Change Act emphasizes application of the precautionary principle when discharging responsibilities and functions or exercising powers. This principle is also applied to ensure that in the event of a threat of damage to the environment or a risk to human safety and health from weather events, geological hazards and the impacts of climate change within Vanuatu, the lack of certainty in terms of

scientific evidence regarding the extent of adverse effects is not used as a pretext to prevent or avoid making a decision to respond to or minimize the potential adverse effects or risks.

The Act also formalized the establishment of key institutions for climate-related services, specifically, the NAB, Department of Climate Change (DoCC), Department of Meteorology (DoM), and Department of Geological Hazards.

Figure 4: Climate Change Act of 2016: – institutional structure



3.4 THE REPUBLIC OF VANUATU'S NATIONAL ENERGY ROAD MAP (NERM) 2016-2030 AND ASSOCIATED NERM IMPLEMENTATION ROAD MAP[8]

This is another ambitious policy guidance tool, first adopted in 2013 and updated in 2016 for the target year 2030. Its vision is *"to energize 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 NERM 2013 identified five priorities for the energy sector: access, petroleum supply, affordability, energy security and climate change. The NERM 2016 was revised and updated to include accessible energy, affordable energy, secure and reliable energy, sustainable energy, and energy for green growth. The NERM 2016 sets out objectives and targets and proposes 68 key actions to achieve these priorities and contribute to the NERM's overall vision.

The priorities reflect the high-level outcomes the Government ultimately seeks to achieve in the energy sector and subsectors (that is, petroleum and other liquid fuels, electricity, and cooking fuels).

The DoE is implementing and monitoring the NERM 2016-2030, as well as an associated comprehensive NERM-IP, including an NERM Monitoring, Verification and Evaluation (NERM-MRV) Plan. The updated NERM 2016-2030 formed the basis for developing the initial NDC and, as such, is critical for achieving Vanuatu's stated NDC targets.

8 Government of Vanuatu (2019), Vanuatu National Energy Roadmap (2016-2030) – Implementation Plan, available from: https://doe.gov.vu/images/docs/publications/Implementation_Plan.pdf

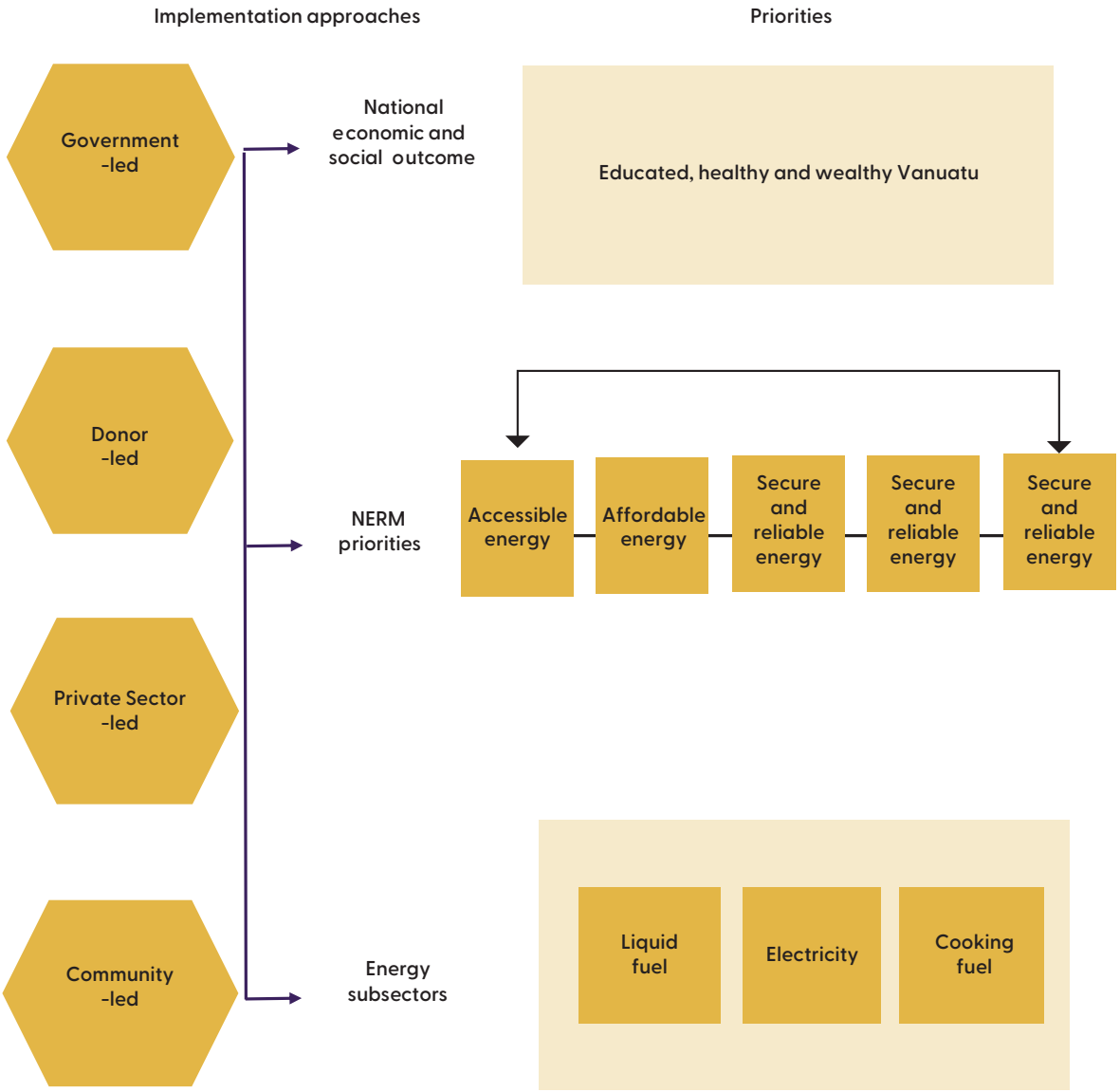
The NERM-IP includes a long list of investments and actions that could help meet the NERM targets. The planned activities were grouped into the following categories:

- Investments and donor programmes
- Policies, laws and regulations
- Analysis and studies
- Capacity-building and institutional development
- Other

This category basically covers the following types of investments:

- Renewable energy
- Rural electrification
- Energy efficiency
- Grid extension

Figure 5: Vanuatu's NERM 2016-2030: priorities and implementation approaches



The NERM 2016-2030, including the IP and MRV Plan, are annexed to this report. The following table summarizes the updated NERM 2016-2030's quantitative targets for 2020 and 2030:

Table 3: Vanuatu's NERM 2016-2030 Priorities and Targets for 2020 and 2030

Priority/Objective		Indicator	2020 target	2030 target
Accessible energy	Increase electricity access by households in and near concession areas	% with access	**90%**	**100%**
	Increase electricity access by households in off-grid areas	% with access	**100%**	**100%**
	Increase electricity access by public institutions (on- and off-grid)	% with access	**100%åå**	**100%**
Affordable energy	Improve the efficiency of diesel generation	Grams of diesel fuel/ kWh of electricity	**20% improvement from year 2012**	**No target (not applicable)**
	Reduce the cost of distributing petroleum products in Vanuatu	Distribution cost in Vanuatu/litre	**10% reduction**	**15% reduction**
Sustainable energy	Increase the proportion of electricity generated from renewable sources	% of grid-based electricity from renewable sources	**65%**	**100%**
	Improve electricity sector end-use efficiency	% savings on BAU projection	**5%**	**13%**
	Improve transport (land and marine) energy efficiency	% savings on BAU projection	**2%**	**10%**
	Improve biomass end-use (cooking and drying) efficiency	% saving on BAU projection	**5%**	**14%**
	Ensure all energy infrastructure projects comply with government and donor environmental and social safeguard requirements	% of projects complying	**100%**	**100%**
Green growth	Increase the proportion of electricity generated from biofuels	% of electricity generated from biofuels	**10%**	**57%**
	Increase renewable electricity use by rural tourism bungalows	% of bungalows using renewable energy sources for electricity supply	**25%**	**65%**

3.5 VANUATU'S CURRENT NATIONALLY DETERMINED CONTRIBUTION (NDC) AND IMPLEMENTATION ROAD MAP[9]

Vanuatu's current NDC mitigation target is to transition to close to 100 percent renewable energy in the electricity (energy) sector by 2030. Achieving this target would involve replacing nearly all fossil fuel required to generate electricity in the country. Vanuatu is taking significant steps towards implementing the PA. The country has developed an NDC Implementation Road Map, including a first-of-its-kind measurement, reporting and verification (MRV) tool. Its purpose is to provide a pathway for implementing and monitoring climate change mitigation actions in Vanuatu that can help to achieve the target defined in Vanuatu's NDC.

The NDC Implementation Road Map (NDC-IR) seeks to provide a pathway for implementing specific mitigation actions in Vanuatu. Under the BAU electricity demand scenario, demand is projected to increase from 77.9 GWh in 2017 to 100.7 GWh in 2030, for a total increase of 29.4 percent.

The NDC-IR has also identified the immediate priority interventions (such as coconut oil as fuel for electricity generation, solar and wind), including regulatory changes and a financial strategy leading to emission reductions and transformational change in the electricity supply sector over time. As part of an NDC initiative, Vanuatu is embarking on implementing an innovative, cutting-edge renewable energy technology using the swarm technology electrification approach.

3.6 RURAL ELECTRIFICATION NAMA

The rural electrification NAMA design document focuses primarily on rural electrification and micro-grids to improve access to electricity in rural areas/outer islands. NAMAs are voluntary, non-binding policy instruments that provide a framework for pursuing a country's national level development goals, while contributing to global greenhouse gas (GHG) mitigation efforts. Thus, their dual objective is to mitigate global climate change, while allowing domestic development objectives to be reached. On the other hand, the NDCs' prime objective is to reduce global GHG emissions, although it is acknowledged that developing countries will have the opportunity to improve population well-being (at least until their per capita emissions reach world average levels, at which time the pressure to reduce emissions will intensify). The NAMA covers two interventions:

- **Intervention 1:** Micro-grids will be established. Rural communities/tourism and agricultural facilities/ health centres/schools are the focus of these micro-grids based on their demand for electricity for lighting, cooling and services from other electrical appliances. The micro-grids will use renewable energy sources (solar, wind and hydro) and will provide electricity for lighting, radio and phone charging for households and for service and production activities in rural productivity zones.
- **Intervention 2:** Existing electricity grids will be expanded on different islands. Households, public institutions and tourism/commercial consumers within the proximity of lines will be connected. Electricity will be provided for lighting, audio/TV, mobile phone charging, coastal fishing (refrigeration of the fish catch), tourism facilities (lodges), agricultural facilities (preparing, processing and packaging produces) and handicraft production.

The total cost of the NAMA is estimated at around $5.5 million. This includes support to cover the investment costs of the two interventions as well as extensive capacity-development efforts. According to the NAMA report, emission reductions over the NAMA's 15- year lifetime will reach around 13,500 tons of CO_2, which amounts to around 900 tons per annum or 0.9Gg per annum.

9 Vanuatu's NDC Implementation Roadmap (2018), available from: https://www.undp.org/content/dam/LECB/events/2019/20190220-ndc-roadmap-vanuatu/undp-ndc-implementation-roadmap-vanuatu-mar-2019.pdf

Under the UNDP NDC Support Programme, Vanuatu's DoE conducted a detailed techno-economic feasibility study for a solar micro-grid for the Wintua and Lorlow village communities in South West Bay on Malekula island. Under the NAMA programme, the MoCC has secured funding from the Government of Austria to implement a solar micro-grid for the Wintua and Lorlow village communities.

3.7 IRENA RENEWABLES READINESS ASSESSMENT

This detailed 2015 report reiterates that, like all Pacific Island Countries (PICs), Vanuatu has excellent solar resources available throughout the country's populated areas that could be used to generate electricity to offset the cost of imported fuels.

The report notes that several solar photovoltaic (PV) projects with total capacity of more than 2.6 megawatts (MW) are under consideration. Interest from independent power producers (IPPs) in solar PV electricity generation has been increasing. Moreover, the first stage 4 MW geothermal plant is expected to go on stream before 2020 and some hydropower may also be added. The Port Vila grid currently has 3 MW of wind and the 26.5 MW diesel generator sets use between 5 percent and 20 percent coconut oil (the quantity depends on the availability and economics of using the biofuel) instead of diesel. The Luganville grid on Espiritu Santo has a 1.2MW hydro plant and 2.9 MW diesel generators. In addition, a small amount of grid-connected solar PV is available.

The report suggests that to fulfil the NERM's goals would require establishing and enforcing technical standards for grid-connected systems and regulatory capacity for small-scale distributed generation systems. In addition, detailed models of the grid need to be developed as the addition of intermittent sources, such as solar PV, could increase the stability of the (30MW) grid system on Efate, in particular.

In terms of major mitigation options, this report identifies a mix of geothermal, wind, biofuels and solar PV as the key technologies suitable for Vanuatu. However, the report does not set ambitious goals in terms of projected installed capacity of PV, citing grid stability concerns that would limit PV penetration to a few MW.

In addition, geothermal sources are still at the exploratory stage and with estimated upper temperatures of around 50–60 degrees C, plant efficiency is likely to be relatively low. One of the problems the report identified was how to handle the large night-time load on the Efate grid from solar PV, in particular. Most of this load is likely to come from air conditioning. One option would be to generate cooled water during the day and circulate the water from storage tanks at night. The other more conventional option for load shifting would be to use storage batteries.

3.8 NATIONAL GREEN ENERGY FUND (NGEF)

To contribute to achieving its energy access and sustainability targets, the GoV approved the creation of the NGEF in April 2016. It is intended to mobilize a pool of financial resources sufficient to provide all households with access to electricity and meet the sustainable energy target by 2030.

The fund will operate as a revolving fund, with anticipated initial start-up capital of $10 million, to be sourced mainly from international sources and yearly contributions from domestically consolidated energy funds, totaling $300,000. It will offer four types of funding:

- Debt via intermediaries, including financial institutions and non-financial institutions in Vanuatu;
- Project equity for project developers and technology providers;

- Risk sharing, in the form of a first loss facility for local banks; and,
- Small grants for public institutions (no more than 5 percent of total fund investments).

Energy efficiency investments should be included, as well as renewable energy development, with a primary focus on increasing energy access in off-grid areas.

3.9 RENEWABLE ENERGY ELECTRIFICATION MASTER PLAN FOR VANUATU

A renewable energy-based off-grid electrification master plan for remote islands of Vanuatu was developed in 2016. It would initially address four pilot islands (Mataso, Makira, Emae and Aneityum) pre-selected by the GoV and subsequently provide for broader replication to further remote islands. The master plan has two main components:

i. Provide preliminary technical designs for renewable-energy based electrification for the four islands; and,

ii. Based on this sample of islands, develop a masterplan for electrifying Vanuatu's outer islands through affordable renewable energy.

3.10 VANUATU NATIONAL FOREST POLICY (2013-2023)

Vanuatu acknowledges the need to adapt to climate change and seeks to "integrate climate change adaptation issues into forestry sector planning and activities." However, enforcement of regulations is hindered by the fact that all forests are privately owned, while the constitution calls on from landowners to manage their land in a way that "safeguards the national wealth, resources and environment in the interests of the present generation and of future generations."

The policy identifies integrating climate change mitigation issues into forestry sector planning and activities as a specific objective. In particular, this includes developing a national REDD+ initiative, to be undertaken by the DoF, the NAB and non-governmental organizations (NGOs).

3.11 REDUCED EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION (REDD+) PROGRAMME

For forestry sector mitigation, Vanuatu is engaging both the government and civil society organizations as main stakeholders in the national REDD+ program in Vanuatu. The DOF, with NAB oversight and the Vanuatu Geo-Hazard and Meteorological Department (VGMD) as the focal point, is taking the lead role as the key implementing agency in implementing the national REDD+ program in Vanuatu.

4. ASSESSMENT OF NATIONAL GREEN HOUSE GAS (GHG) EMISSIONS[10]

The National Greenhouse Gas (GHG) inventory of anthropogenic (human-caused) GHG emissions and removals was estimated for the Republic of Vanuatu under the first, second and third (draft) National Communications for 1994, 2000 and 2015. Vanuatu's per capita GHG emissions in 2015 totaled approximately 2.302 tCO_{2e}/person (population of 265,000), compared to the world average for the same year of around 7.235 tCO_{2e}/person). In absolute terms, Vanuatu's CO_{2e} emissions totaled approximately 0.0011 percent of global GHG emissions for 2015. The following table summarizes the national GHG inventories.

Table 4: Vanuatu's National GHG Inventory (excluding removals)/1994, 2000 and 2015

National GHG Inventory (excluding removals)	Net CO_2 emissions, (CO_2 Equivalents Gg)		
Categories	**1994**	**2000**	**2015**
1 - Energy	**64.227**	**70.344**	**129.550**
1.A - Fuel combustion activities	**64.227**	**70.344**	**129.550**
1.A.1 - Energy industries	12.695	30.207	32.194
1.A.2 - Manufacturing industries and construction	0.930	1.077	19.943
1.A.3 - Transport	45.292	34.688	72.135
1.A.4 - Other sectors	5.309	4.373	5.277
2 - IPPU	-	-	-
3 - AFOLU	**235.160**	**502.829**	**428.090**
4 - Waste	-	**12.213**	**37.275**
Total GHG emissions, excluding removals	**299.387**	**585.387**	**610.204**

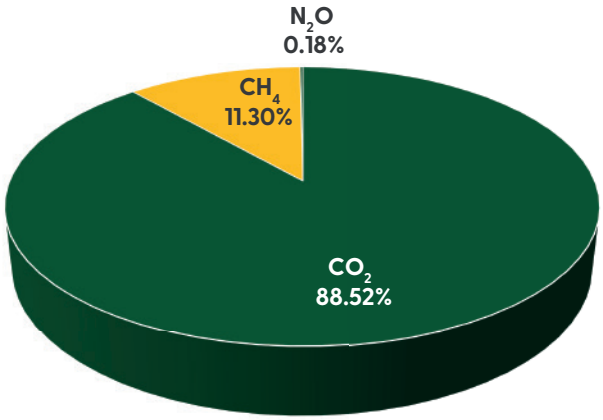
National GHG emissions, excluding removals, totaled 610.204 Gg CO_{2e} in 2015, compared to 299.387 Gg CO_{2e} estimated for 1994 under the first national communication and 585.387 Gg CO_{2e} estimated for 2000 under the second. The 2015 total breaks down into 128.206 Gg of direct CO_2 emissions, 14.818 Gg of CH_4 emissions and 0.253 Gg of N_2O emissions.

Vanuatu's net CO_2 emissions come primarily from the energy sector and its subsectors (due to fossil fuel combustion) and account for approximately 100 percent of total CO_2 emissions. Those emissions have trended upwards, including under the inventory period 1994-2015. Net CO_2 emissions in 1994 totaled 64.227 Gg and nearly doubled to 128.206 Gg) in 2015. The marginal dip in 2009 and 2012 was due to less petroleum consumption and an economic slowdown. Fossil fuel combustion remains the main contributor of CO_2 emissions in Vanuatu.

The subsector analysis of total CO_2 emissions suggests that they come primarily from the transportation subsector (47.27 percent), including road transport (80 percent), domestic aviation (12 percent) and domestic water-borne navigation (8 percent). Energy follows (32.5 percent), composed of electricity generation, manufacturing industries and construction (15.27 percent), and the remainder comes from other sectors (4.96 percent), including the commercial, institutional and residential subsectors.

10 Vanuatu's Third National Communication to the UNFCCC - Draft (2020)

Figure 6: Vanuatu's total GHG emissions by gas (2015)

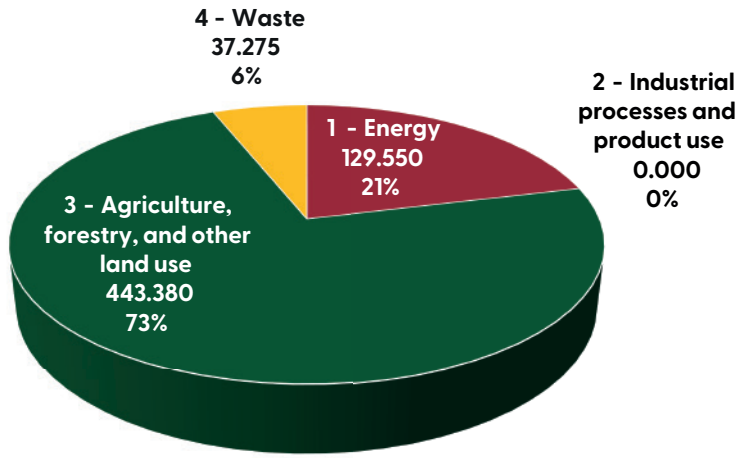


Over 92 percent of net methane (CH_4) emissions come from the agriculture sector and its subsectors, mainly livestock, through enteric fermentation and manure management. The waste sector (solid waste and wastewater) is the second-largest source of CH_4 emissions, accounting for about 7.78 percent of methane emissions. The energy sector produces a minor fraction of methane, primarily as emissions from fossil fuel combustion (0.03 percent).

Net CH_4 emissions in year 2007 totaled 4.057 Gg and increased by 5 percent to 14.818 Gg in 2015. This increase was due to an increase in the number of livestock, unscientific and unorganized waste management practices over that period, and open dumping and decay of waste.

Vanuatu's net nitrous oxide (N_2O) emissions in 2015 were estimated at 0.253 Gg in 2015, with an increase of approximately 5 percent increase between 1994 and 2015. The average net N_2O contributions to Vanuatu's total GHG emissions has been minimal, at around 0.18 percent. The main sources of N_2O emissions are livestock manure management (68.3 percent), land management (25 percent), waste water (5.2 percent) and the energy sector (1.5 percent).

Figure 7: Vanuatu's total 2015 GHG emissions by sector (excluding removals)

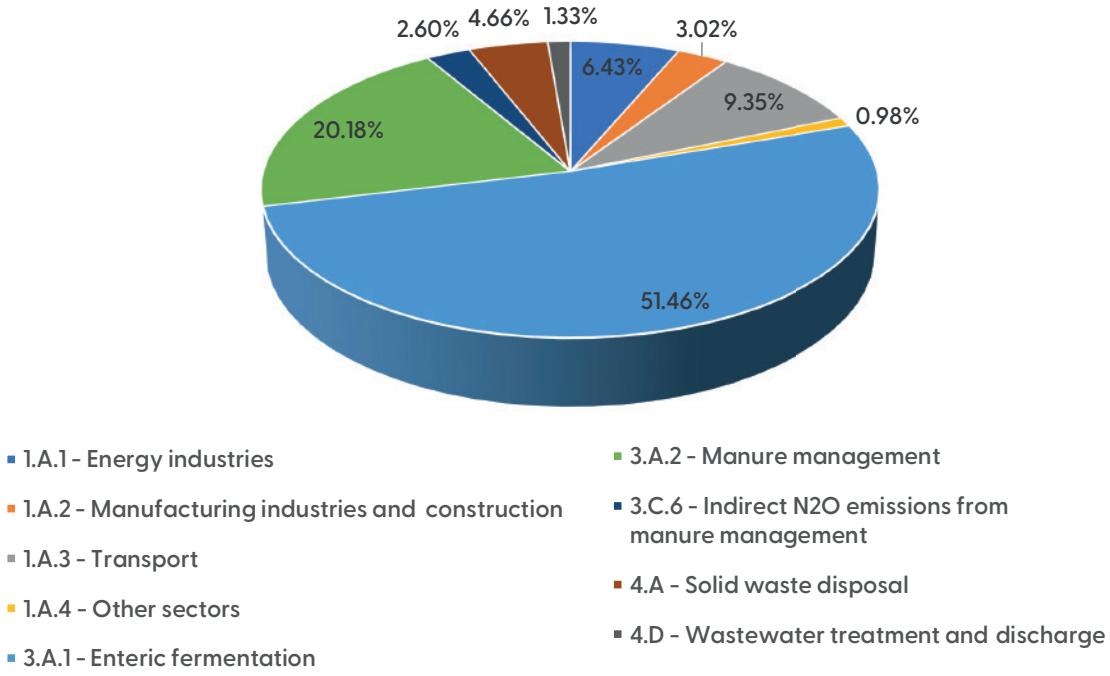


Emission of other GHGs, including perfluorocarbons, hydrofluorocarbons and sulphur hexafluoride (SF6), in Vanuatu is negligible, as the products containing these gases are not produced in the country. Apart from direct GHG emissions in Vanuatu, other indirect emissions, such as NOx, CO, NMVOC and SO2, do occur but the quantities are negligible.

However, Vanuatu remains net carbon negative in terms of GHG emissions when removals (CO_2 sink from forestry) are taken into account.

The emission data suggest that three major sectors contribute to Vanuatu's GHG emissions: energy; agriculture, livestock and land use; and waste. The following figure presents the contribution from each of these GHG emission sectors and subsectors.

Figure 8 : Vanuatu's total 2015 GHG emissions by subsector, (excluding removals)



Details of national GHG emissions and GHG emissions profiling with emission data are presented in the National GHG inventory reports.

5. CIRCULAR ECONOMY OPPORTUNITIES IN VANUATU: SUMMARY OF RECOMMENDATIONS FOR NDC UPDATE[11]

This section provides an overview of the metabolic analysis conducted, including recommendations to define a resource efficient and low-carbon future for Vanuatu. The key objective of the analysis was to identify additional mitigation measures, in addition to the conventional IPCC sectors, to further enhance Vanuatu's Nationally Determined Contribution to its climate commitments under the PA.

Resource use for consumption in Vanuatu is estimated to be 58 percent, or relatively, circular[12]. This means that the country relies on secondary or renewable materials and energy sources for 58 percent of materials used for domestic consumption. The remaining 42 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 by polluting 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. CE analytics can identify opportunities that contribute to that objective, as the circular economy 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 an economy that is 58 percent circular, it far exceeds the global average of 8.6 percent,[13] Austria's 9.7 percent and the Netherlands' 24.5 percent.[14] 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.

The CE opportunities proposed in this CE analysis can, between today and 2030, help avoid 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. Composting may be used where volumes are too small for a biogas plant;
- Collaborating with development partners to develop circular procurement to reduce waste, resource extraction and GHG emissions associated with investments;

11 Circular economy opportunities in Vanuatu -A metabolic approach to define a resource efficient and low-carbon future (2020)
12 Circle Economy calculated this value based on the metrics proposed in its National Circularity Gap analysis for Austria, the Netherlands and Norway.
13 Circle Economy and Shifting Paradigms (2019), '3rd Global Circularity Gap report: When circularity goes from bad to worse: The power of countries to change the game.'
14 Circle Economy (2020), 'The Circularity Gap Reporting Initiative: A global score for circularity,' available from: https://www.circularity-gap.world/.

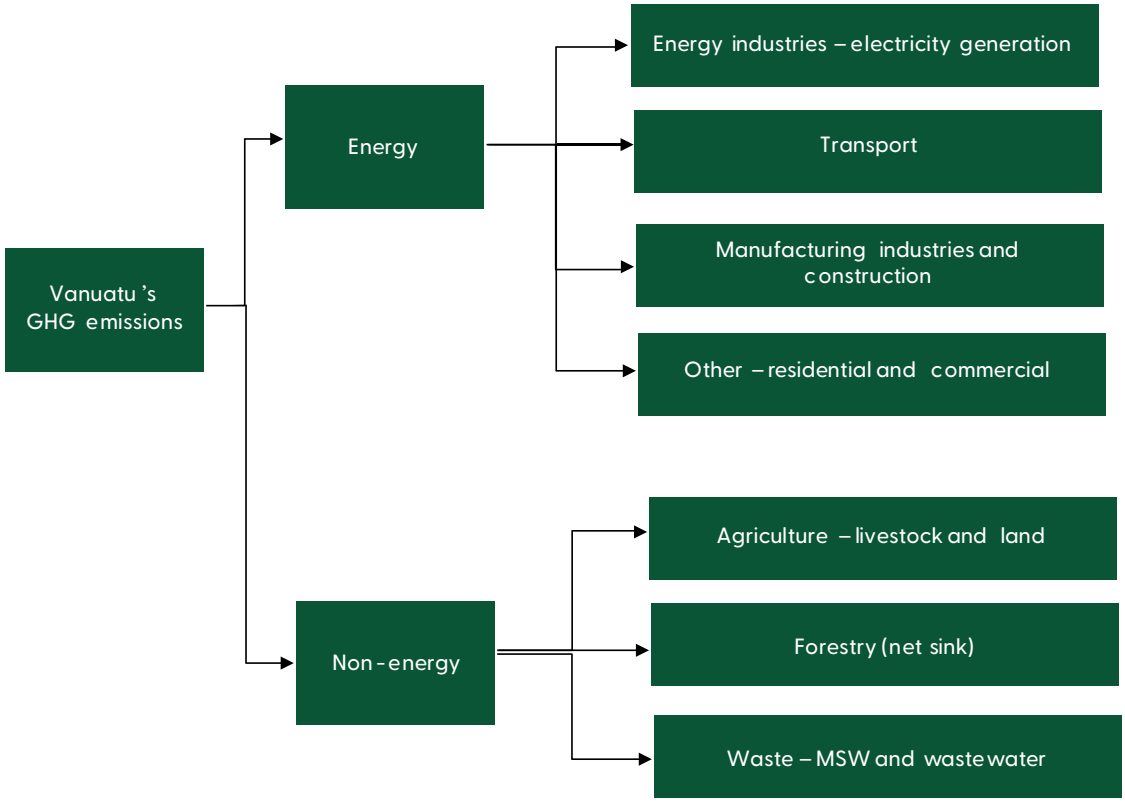
- Aligning Vanuatu's tax regime with its development ambitions, increasing government revenue by taxing pollution and using these revenues to support the transition to a CE; and,
- Collecting and sorting recyclable materials and exporting those that cannot be used or processed domestically, while using import levies to compensate for the low international prices for secondary resources.

Please refer to Annex 2 for the list of recommendations from the metabolic analysis for Vanuatu. The recommendations considered for inclusion under the updated NDC have been included and developed in the relevant mitigation sectoral analyses.

6. SECTORAL GHG MITIGATION POTENTIAL ASSESSMENT[15]

As discussed in the previous section, Vanuatu's key GHG emission sources can be classified into two categories: energy-related emissions (due to fossil fuel combustion); and non-energy GHG emissions (AFOLU and waste). The forestry sector is a net sink.

Figure 9 : Vanuatu's GHG emissions: sectors and subsectors (excluding removals)



6.1 ENERGY SECTOR

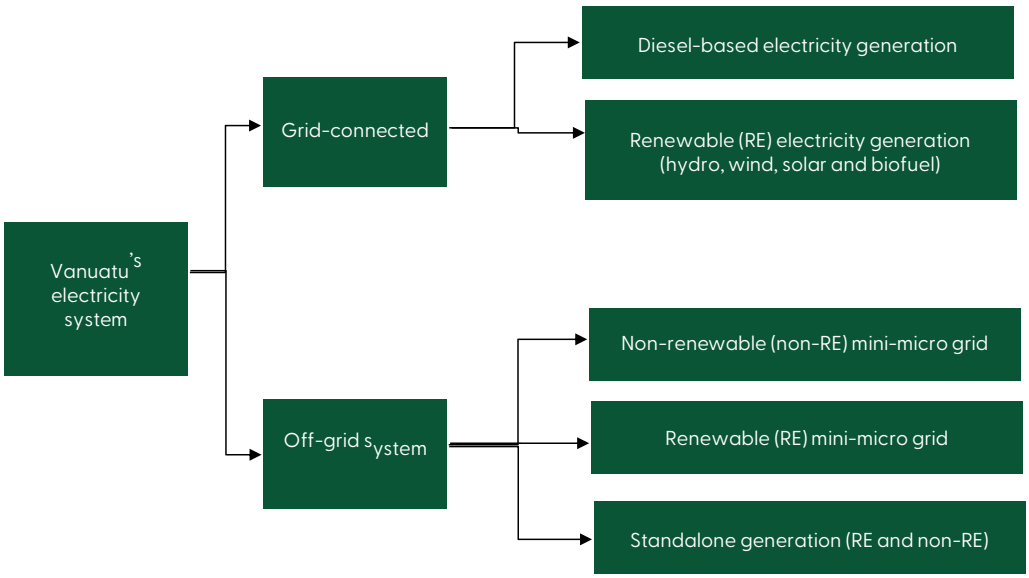
As discussed above, the energy sector is one of Vanuatu's leading GHG emitters. Energy sector emissions come from fuel combustion activities (fossil fuels or petroleum products) associated with the energy industry (electricity generation), manufacturing industries and construction, transportation (road and domestic aviation and water-borne navigation, excluding international aviation and international marine transport), and other sectors (such as commercial, institutional and residential).

6.1.1 ENERGY INDUSTRIES – ELECTRICITY GENERATION

The energy industries or electricity generation subsector contributes about 25 percent of total CO_2 emissions from the energy sector and about 5 percent of Vanuatu's total CO_2 emissions. The country's electricity system can be classified into two types: grid-connected and off-grid. Off-grid systems can be broken down further into mini-micro grids and standalone electricity generation systems (both renewable and fossil fuel-based).

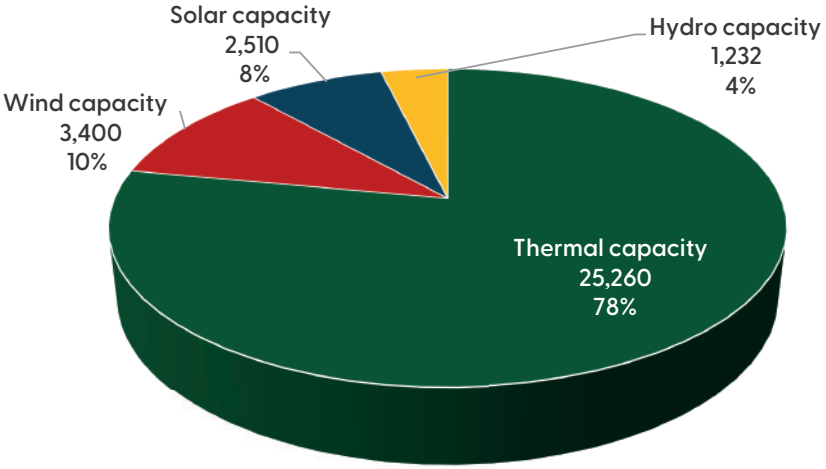
15 Data modelling and analysis of Vanuatu's GHG emission scenarios for Vanuatu's NDC update (2020)
Government of Vanuatu (2019), Vanuatu National Energy Roadmap (2016-2030) – Implementation Plan, available from: https://doe.gov.vu/images/docs/publications/Implementation_Plan.pdf
Vanuatu's Utilities Regulatory Authority – Electricity Fact Sheet (2014-2019), available from: http://www.ura.gov.vu/attachments/article/97/Electricity%20Fact%20Sheet%202014%20-%202019%20-Final.pdf
Pacific Petroleum Sectoral Fuel Delivery Data: 2007-2017- Personal Communication
Origin Energy -LPG Import & Sales Summary 2007- 2017 - Personal Communication
Vanuatu Customs – Fuel import data 2007-2017 - Personal Communication

Figure 10: Vanuatu's electricity systems



As of 2015, Vanuatu had total installed capacity of approximately 37 MW. However, the 33 percent electrification rate is very limited, due primarily to the islands' remoteness, terrain that makes grid expansion difficult and the high cost of renewable energy. Out of 50,740 total households in Vanuatu, only 16,571 have access to grid/mini-grid electricity or renewable energy-based own generation. However, overall peak demand in Vanuatu has been increasing steadily, from 11.9MW in 2010 to 14.2 MW in 2015.

Figure 11: Vanuatu's existing installed capacities 2019 (kW)



Two electricity utilities - Vanuatu Utilities and Infrastructure Limited (VUI) for Luganville and UNELCO Engie (UNELCO) for Efate Island – operate grid-connected electricity. Vanuatu's Utilities Regulatory Authority (URA) regulates the country's electricity sector.

Figure 11 depicts total installed capacities and breakdown based on source of electricity generation with diesel and bio-fuel (82%) followed by, wind power (11%), hydro power (4%), and solar power (0.2%).

As Figure 11 shows, diesel-based generation is the main source of electricity, with total installed capacity of about 25.2MW (78 percent), followed by wind at 3.4 MW (10 percent), solar at 2.51 MW (8 percent) and hydro at 1.232 MW (4 percent). Diesel-based electricity generators are the major source of GHG emissions. Further, generation efficiency of the diesel generation plants is also an important aspect of higher diesel consumption in the energy sector. The GoV has identified GHG emissions from electricity generation as key to reducing overall GHG emission and an important feature in achieving energy security and provide affordable energy.

The government also developed the NERM 2016–2030 to improve electricity access and affordability and, simultaneously, reduce GHG emissions. The various plans under the NERM have already been implemented and others are at various stages of planning and implementation. As of 2019, total grid-connected electricity generation capacity had reached 32.4 MW with total annual electricity generation of 80.5 GWh. Figure 12 illustrates thermal and renewable generation over the period 2011-2019.

Figure 12: Vanuatu's energy generation mix 2011-2019 (kW)

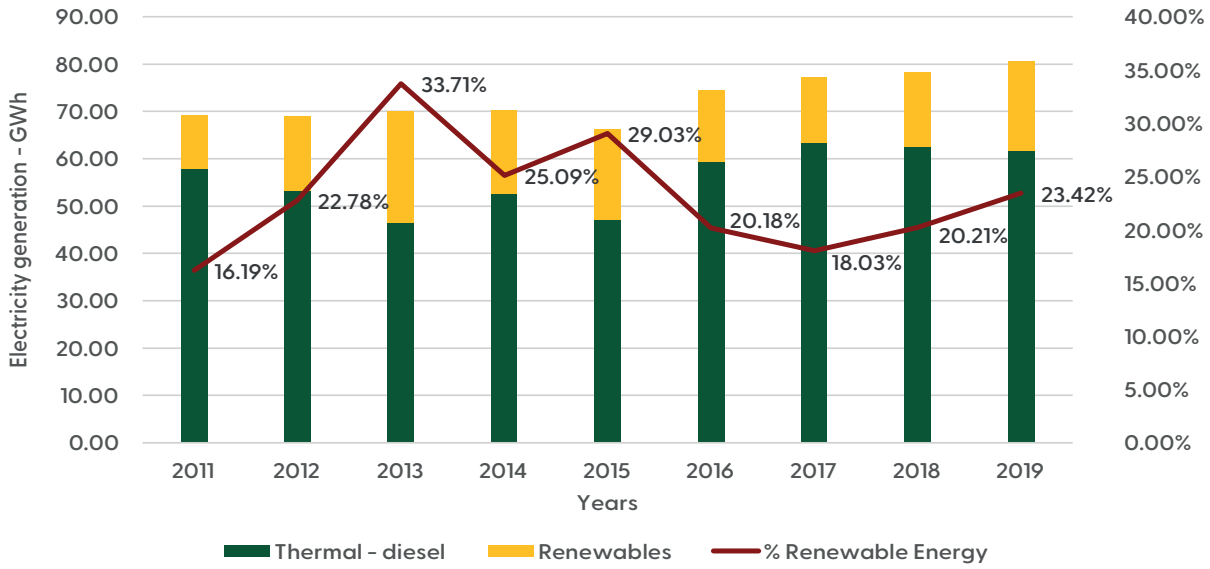


Figure 13: Share of type of renewable energy in total RE generation 2011-2019 (%)

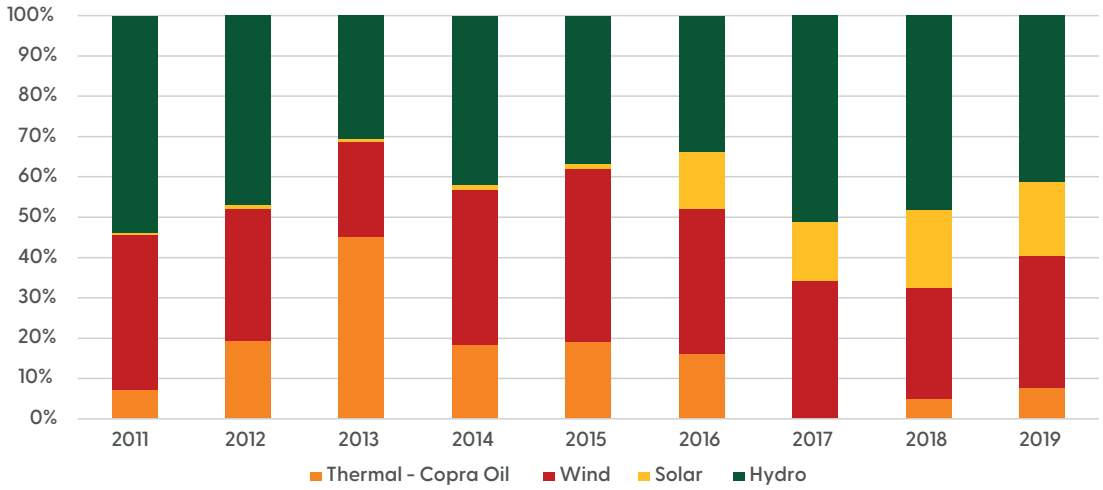
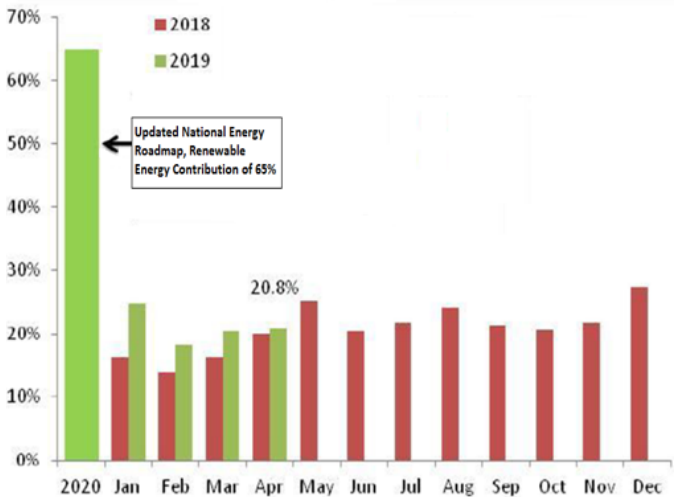


Figure 14: Renewable energy generation (2018-2019) with NERM additions



6.1.1.1 Energy industries – current NDC targets (existing measures)

Vanuatu's current NDC, submitted in 2016, identified the energy industry (electricity generation) subsector as a main mitigation contributor and set a conditional target[16] of **achieving close to 100 percent renewable energy in the electricity sector by 2030**. This is a very ambitious target for Vanuatu and would replace nearly all fossil fuel required to generate electricity in the country. It would be consistent with the NERM 2016 target of 65 percent renewable energy by 2020. This contribution would reduce energy sector emissions by 72Gg by 2030. Those emissions totaled approximately 130 Gg in 2010, but are expected to rise to 240 Gg by 2030 (3 percent/year). Current NDC targets and actions are summarized in Table 5.

Table 5: Vanuatu's first NDC mitigation targets

Vanuatu's first NDC's mitigation sector targets

Timeframe	2020-2030
Contribution	Sectoral commitment focussed on a transition to renewable energy in the electricity generation subsector under energy generation.
Target	To approach 100 percent renewable energy in the electricity subsector contingent upon appropriate financial and technical support.
GHG reductions	100 percent below BAU emissions for the electricity subsector and 30 percent for the energy sector as a whole.
	Energy Sector: Mainly electricity generation subsector, but ancillary mitigation possible in forestry, agriculture, transport and energy efficiency sector-wide. The key planned mitigation interventions include:

Serial no.	Key interventions	Target year
1.1	Double installed wind capacity to 5.5 MW	2025
1.2	Install 10 MW grid-connected solar PV	2025
1.3	Commission the first 1st-stage 4MW geothermal plant	2025
1.4	Add 10 MW grid-connected solar PV	2030
1.5	Commission the first 2nd-stage 4MW geothermal plant	2030
1.6	Substitute and/or replace fossil fuels with coconut oil-based electricity generation	2025

The proposed interventions would require substantial external funding, totalling approximately $180 million, to proceed in line with the necessary timeframe. In addition, substantial technology transfer would be required, including institutional support and training.

Sectors/ subsectors

Additional planned mitigation interventions include:

Serial no.	Key interventions
2	National Energy Road Map -NERM ($ 210.5 million indicative, with some overlap)
3	Rural Electrification NAMA ($ 5 million indicative)
4	Off-grid renewable energy projects under Scaling Up Renewable Energy in Low Income Countries Program (US $34.2 million)
5	Energy efficiency measures to be pursued across the board to enable 15% savings in the energy sector
6	Forestry sector measures to reduce deforestation and promote good land care to accepted mitigation practices according to REDD+
7	Planned cooperation with New Zealand and other nations interested in mitigating methane (CH_4) and associated emissions for ruminant and pasture management

16 Conditional target: Depends on funding to achieve this transition provided by external sources, financial and technical support availability and with reference to country specific requirements and capacities.

The energy industry/electricity subsectors targets discussed above will be implemented under the national energy sector programmes such as NERM, the Rural Electrification NAMA and the NDC implementation road map.

The following part of this report includes the current status of NDC intervention implementation and options to enhance/accelerate implementation.

Table 6: Vanuatu's current NDC Targets, status and potential for enhancement

Serial no.	Key interventions	Target year	Status[17]	Comments	Possibility of enhancement
1.1	Double installed wind capacity to 5.5 MW	2025	3.40 MW (As of 2019)	**NERM-IP/NDC Road Map:** Addition of 5.1 MW (Option 1) or 2.6 MW (Option 2) on Efate	**Yes**
1.2	Install 10 MW grid-connected solar PV	2025	2.54 MW (As of 2019)	**NERM-IP/NDC Road Map:** Addition of 7.6 MW on Efate	
1.3	Commission the first 1st-stage 4MW Geothermal plant	2025	-	-	-
1.4	Add 10 MW grid-connected solar PV	2030	-	**NERM-IP/NDC Road Map**	**Yes**
1.5	Commission the first 2nd-stage 4MW Geothermal plant	2030	-	-	-
1.6	Substitute and/or replace fossil fuels with coconut oil-based electricity generation	2025	Under discussion	**NERM-IP/NDC Road Map**	**Yes**

The energy industry or electricity generation NDC target is planned to be implemented through two main actions: **NDC Action 1: Add renewable energy capacity and NDC Action 2: Substitute and/or replace fossil fuels with coconut oil for electricity generation**.

NDC Action 1 (Existing measure 1): Add renewable energy capacity

The renewable energy capacity addition plan has been developed and defined under NERM. The NERM 2016-2030 includes proposed activities and actions to achieve the NDC targets; the activities are categorized as implemented, ongoing, and proposed.

17 Source: Utilities Regulatory Authority Electricity Fact Sheet: 2014 – 2019 (September 2020).

Table 7: Energy industry (electricity generation) projects under NERM 2016

Serial no.	Key interventions	Status
1	Undine Bay solar PV system (510kW)	Implemented
2	GPOBA Grid- Based Electricity Project	Implemented
3	Kawene 1.5MW grid-connected solar facility, Efate	Implemented
4	Loltong Hydro Project, North Pentecost	Implemented
5	Plug-and-play solar home system for rural households and institutions (under Vanuatu Rural Electrification Project I (VREP I))	Ongoing
6	Talise Hydro Project, Maewo	Implemented
7	Whitesands solar PV micro-grid, Tanna	Proposed
8	Efate grid-connected solar PV project (1MW)	Implemented
9	Sarakata Hydro Power Extension Project (600KW), Santo	Proposed
10	Vanuatu Energy Access Project – Brenwe hydropower plant (400 kW) on Santo; grid extension on Santo and Malekula	Ongoing
11	Improving diesel generation efficiency	Ongoing
12	Solar PV mini-grid (73kW) for the Wintua and Lorlow communities, Malekula	Implemented
13	Biofuel projects in Saratamata, in Ambae and Sola in Vanuatu Lava	Implemented
14	Swarm technology-based RE electrification of Lelepa island, around 100 households (Power-Blox, Switzerland)	Ongoing
15	Solar/RE hybrid mini-grids under VREP phase 2	Proposed
16	Revision of Electricity Supply Act and Coconut for Fuel Strategy	Proposed
17	Exploration study of distributed energy generation by installing micro/ mini-grids in concession areas (Efate, Santo, Malekula and Tanna) in locations where grid extension is difficult or very expensive.	

Further, Vanuatu's Rural Electrification NAMA has been designed to provide off-grid electrification for households, public buildings and institutions, and businesses. The NAMA is intended to help the GoV achieve the targets described in the NERM 2016, specifically:

- 100 percent connection rate for households close to concession areas by grid extensions; and,
- 100 percent electrification for off-grid households through micro-grids and individual solutions (solar home systems).

The NAMA incudes two main interventions:

Intervention 1: Installation of micro-grids in off-grid areas with concentrated electricity demand (around communities/health centres/schools). New renewables-based micro-grids will be installed, focused on supplying electricity for lighting, cooling and appliances for rural communities, tourism and agricultural facilities, health centres and schools. A back-up power supply is anticipated (powered, preferably, by batteries and/or diesel generators), and feed-in tariff systems will be developed, defining the micro-grid operator's pricing and take-off requirements.

Intervention 2: Extension of grids to neighboring communities. The existing grids form the basis for grid extensions to households, public institutions and tourism/commercial consumers within the proximity of lines. Connecting new consumers will reduce emissions as electricity generated from the grid will be less carbon intensive than energy sources that households have relied on traditionally.

NDC Action 2 (Existing measure 2): Substitute and/or replace fossil fuels with coconut (copra) oil-based electricity generation

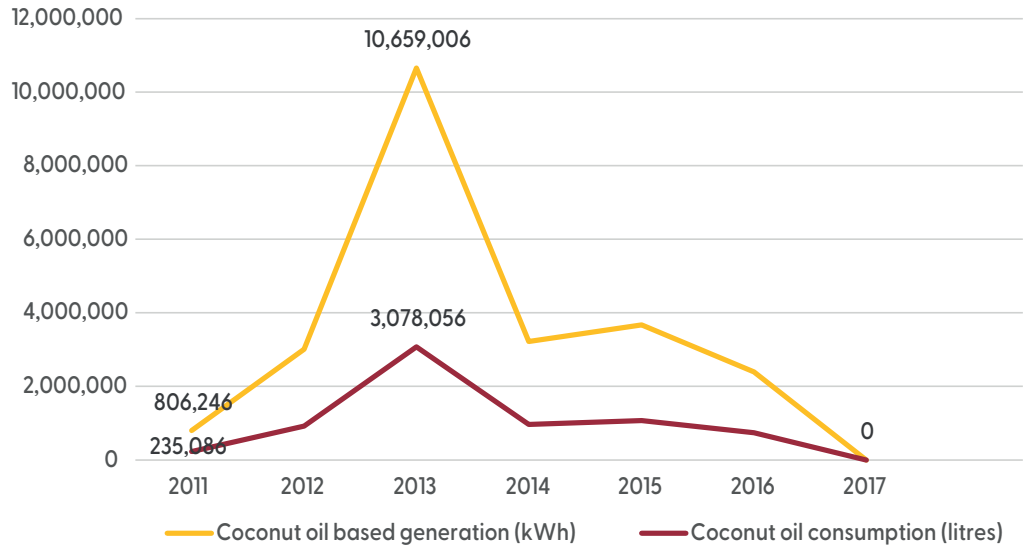
Coconut (copra) oil as a substitute for diesel fuel is a proven technology in Vanuatu and other PICs. This NDC action also constitutes a direct source of economic and social development by fostering employment and income-generating opportunities for the country's coconut-producing regions, while reducing the need to import diesel.

Greater use of coconut oil is anticipated to help achieve the renewable electricity generation target. As it involves substituting for existing fuels, it does not rely on increased demand or require new generation infrastructure for grid-based electricity systems,

However, it does require financing and capacity-building to develop coconut supply chain and incentive-based pricing mechanisms, as the price of coconut oil on the international market affects producers' willingness to supply it to electricity generators.

Furthermore, achieving this target could come at the cost of other NERM target and priorities; that is, by increasing the efficiency of diesel generation efficiency (coconut oil has a lower energy content than diesel, so more is required to produce electricity). Figure 15 presents the consumption of copra oil-based generation and total coconut oil consumption over 2011-2019.

Figure 15: Coconut oil-based generation and coconut oil consumption (2011-2019)



In 2015, the GoV, led by the Ministry of Agriculture and Rural Development, published the Vanuatu Coconut Strategy 2016-2025. The coconut sector is the most important agricultural sector in the country and is the second largest contributor to foreign exchange earnings after tourism.

The strategy is based on the vision that coconut will become the top income earner in Vanuatu's agriculture sector by 2026. This could be achieved by pursuing the following objectives:

1. Establish appropriate administrative and regulatory frameworks to manage the coconut sector;

2. Increase farmers' access to improved planting materials,

3. Enhance coconut farming through appropriate information and support;

4. Increase production and quality through good agricultural practices;

5. Introduce incentives for private sector engagement in agro-processing and value adding at all levels of the value chain; and,

6. Enhance trade and marketing of coconut products in the domestic and export markets.

All these objectives are relevant to increase the share of coconut oil as a source for electricity generation. The considerable effort and cost to ship coconut oil internationally will decrease, which benefits the entire sector.

In light of the above, the MoCC is establishing a technical task force involving key stakeholders to monitor progress and use of coconut for fuel in the country.

When established, the task force's mandate will be to oversee and provide input on successful development and implementation of Vanuatu's coconut-for-fuel strategy. This strategy is expected to be the key element and first step in making a sizeable contribution to achieving the NDC target by establishing the systems and structures required to increase the use of coconut oil for electricity generation, including value addition to the local economy.

6.1.1.2 Energy industries – emissions scenarios

A GHG emissions scenario has been developed for Vanuatu's energy industry (electricity generation subsector) using the applicable guidance for estimating projected GHG emissions (UNFCCC, 2004, 2016 and DG CLIMA, 2012).

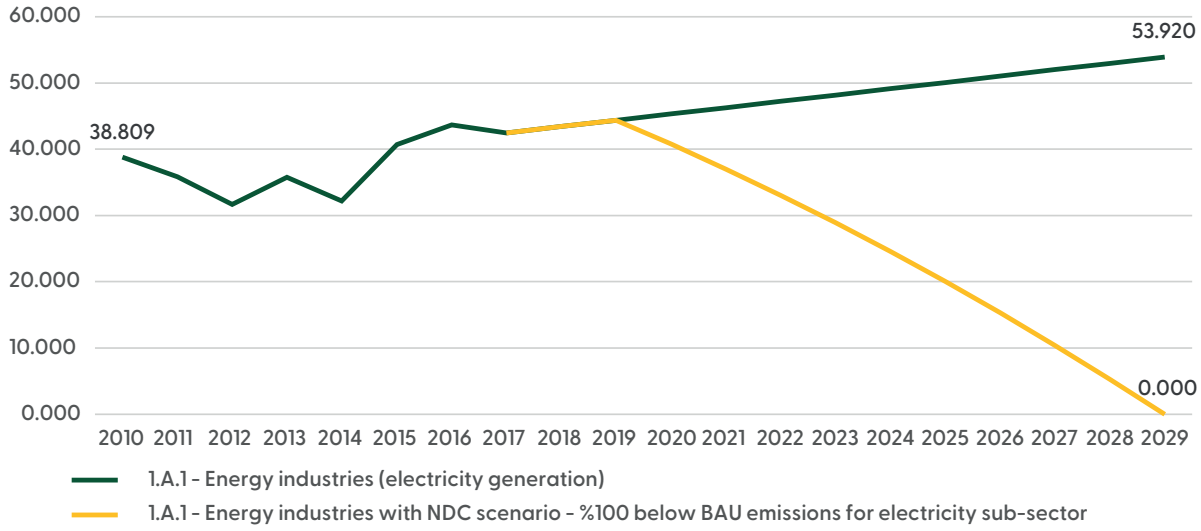
The emissions scenarios are based on historical emissions, with projections for the period 2010-2030 made using the statistical model. Three scenarios have been developed:

- **BAU scenario or WOM:** Assessment based on what might happen if Vanuatu takes (or has taken) no action (WOM).
- **NDC scenario or WEM:** Assessment based on what might be achieved with the actions that Vanuatu is committed to take under the existing NDC (WEM or, sometimes, known as WM).
- **Enhanced NDC scenario or WAM:** Assessment based on additional measures identified and to be included as enhanced NDC actions; that is, what more Vanuatu could do to further enhance the climate change-related ambitions (WAM). (Note: The emissions scenario with additional measures is included later in this report.)

These three scenarios have been assessed using the same set of historical data and the projections. The projected estimates thus reflect the impacts of relevant actions on GHG emissions. However, emission projections are estimates only, given the assumptions (GDP growth rate, population, electrification, transport and technology uptake).

- **BAU scenario or WOM:** Estimated energy industry (electricity generation subsector) 2030 emissions under the BAU scenario would total approximately 53.920 Gg CO_{2e}.
- **NDC scenario or WEM:** As per the existing NDC measures, the target is to achieve 100 percent renewables-based electricity generation; thus, GHG emissions under the existing NDC (WEM) would achieve neutrality (zero Gg CO_{2eq}) in 2030.
- **Enhanced NDC scenario or WAM:** No additional actions required.

Figure 16: Energy industry/GHG emissions (Gg CO_{2eq}) scenarios



The existing NDC commitment to move towards 100 percent RE-based electricity generation in Vanuatu results in nearly zero emissions by 2030. Thus, no additional measures/action/enhancement are required for the electricity generation subsector.

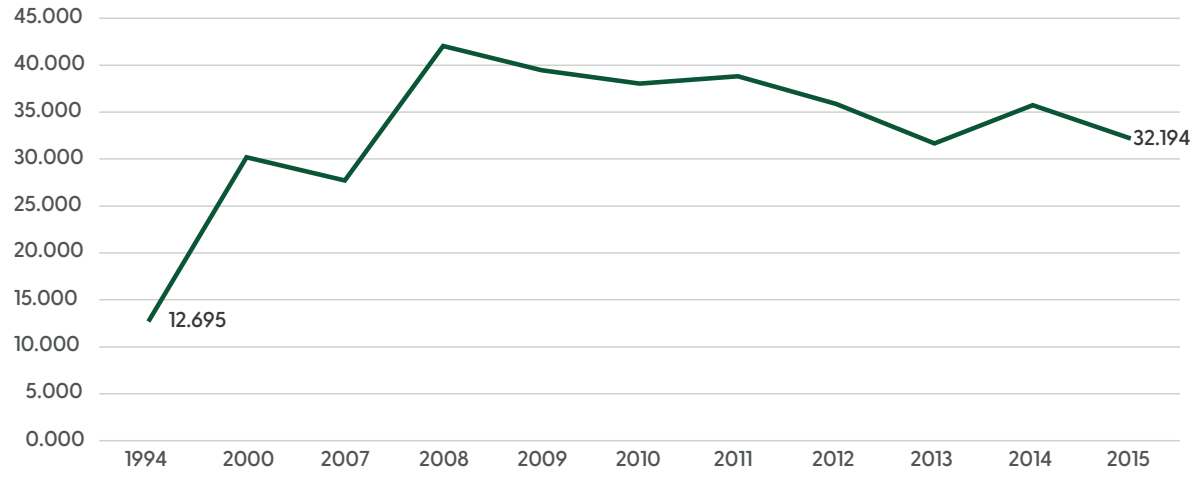
6.1.2 MANUFACTURING INDUSTRIES AND CONSTRUCTION

Vanuatu has a small manufacturing and construction base that serves primarily the local market and exports, with GDP value added of around 4 percent (2015). The manufacturing, industry and construction subsector comprises manufacturing and food processing (primarily related to agriculture, livestock, fishery and forestry), construction, quarry, wholesale and retail service sectors (industries). However, Vanuatu has untapped potential to move up the industrial value chain. For example, Vanuatu's organic beef is well-known internationally and an important export product, along with cocoa, coffee, kava, wood and wood products.

This subsector, under the energy sector, is the third-largest GHG emitter (about 3.02 percent) and fossil fuel consumer in Vanuatu. Its main GHG emissions are CO_2 emissions from the consumption of fossil fuels (gas/diesel oil, gasoline/petrol, kerosene, aviation gasoline, jet kerosene, liquefied petroleum gas (LPG)), lubricant and oil.

GHG emissions from the manufacturing and construction subsector for 2010 and 2015 totaled 23.671 Gg CO_{2e} and 19.943 Gg CO_{2e}, respectively. The following figure presents historical GHG emissions from this subsector.

Figure 17: Manufacturing and construction subsector/GHG emissions (Gg CO_{2eq})



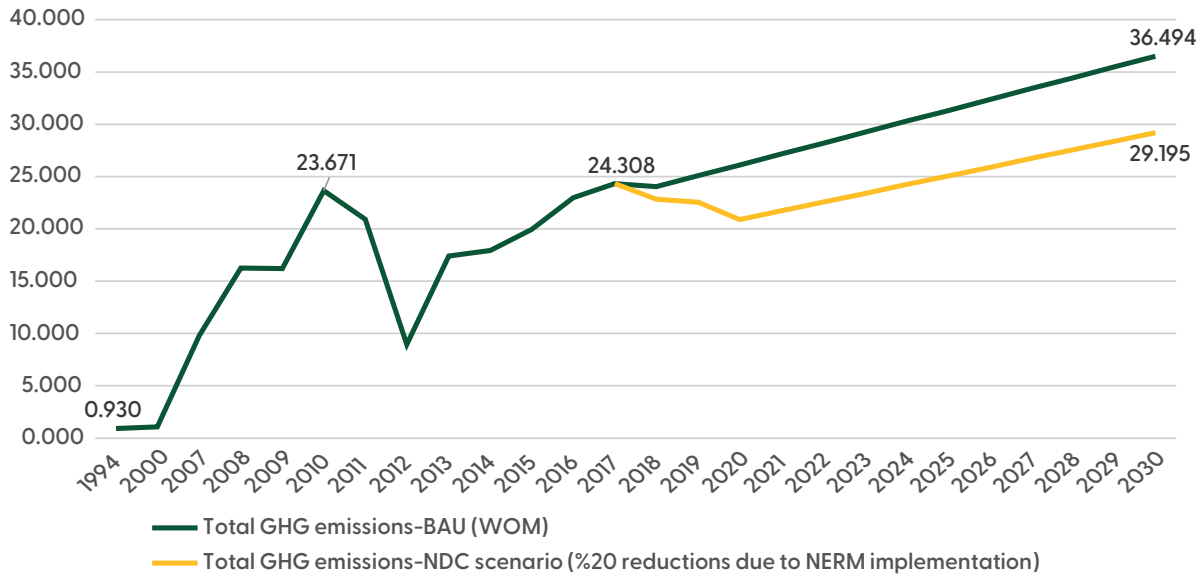
As discussed above, the manufacturing and construction subsector is not a large contributor to Vanuatu's total GHG emissions. However, it has been considered a potential GHG mitigation subsector and mitigation measures are defined under the NERM 2016-2030. The existing NDC does not define specific targets for this subsector. Nevertheless, the expected cumulative impact of NERM implementation – that is, increased energy access and availability, increased energy efficiency on both the demand and supply sides, and increased energy generation efficiency - is expected to reduce GHG emissions by approximately 20 percent annually. The cumulative actions (existing and additional mitigation measures) with the GHG emissions reduction potential from manufacturing and construction subsector have been discussed in the GHG emissions scenarios.

6.1.2.1 Manufacturing industries and construction - emissions scenarios

GHG emissions scenarios have been developed for the manufacturing industries and construction subsector for 2010-2030 (applicable guidance and approach are discussed above under the energy industry subsector). The emissions scenarios are based on historical emissions and the cumulative impact of NERM implementation.

- BAU scenario or WOM: Under the BAU, or WOM, scenario GHG emissions from this subsector are expected to reach 31.304 Gg CO_{2e} in 2025 and 36.494 Gg CO_{2e} in 2030.
- NDC scenario or WEM: under the existing NDC (WEM or WM scenario), the subsector's emissions are expected to decline by 20 percent annually to 2030.

Figure 18: Manufacturing industries and construction/GHG emissions (Gg CO_{2eq}) scenarios



Vanuatu's existing NDC energy sector commitment (increased electricity access, energy efficiency measures including biomass and renewable energy applications) reduces annual GHG emissions from this subsector by nearly 20 percent annually. Thus, the current NDC update does not recommend additional measures/action/enhancement.

6.1.3 TRANSPORT

Transportation is a vital sector that has contributed enormously to achieving Vanuatu's development objectives. It will continue to serve as a driver for economic growth and development. Vanuatu's transport sector has seen significant growth in the past few years, but has become the energy sector's largest GHG emitter and fossil fuel consumer. It includes inland road transportation, domestic aviation and marine

transportation. Vanuatu has no rail network and, considering its geographical limitations, is unlikely to initiate a rail network in the future. The transport subsector accounts for over half of Vanuatu's domestic petroleum demand (excluding bunkering, international aviation and international maritime).

GHG emissions from Vanuatu's transport subsector totaled 52.089 Gg CO_{2e} in 2010 and had increased 38 percent by 2015 (72.135 Gg CO_{2e}), for a compound annual growth rate of about 6 percent. Of the three main modes of transportation - road, aviation and marine), road/land transport consumes just over 50 percent of all petroleum products imported for domestic consumption.

Figure 19: Transport subsector/GHG emissions (Gg CO_{2eq})

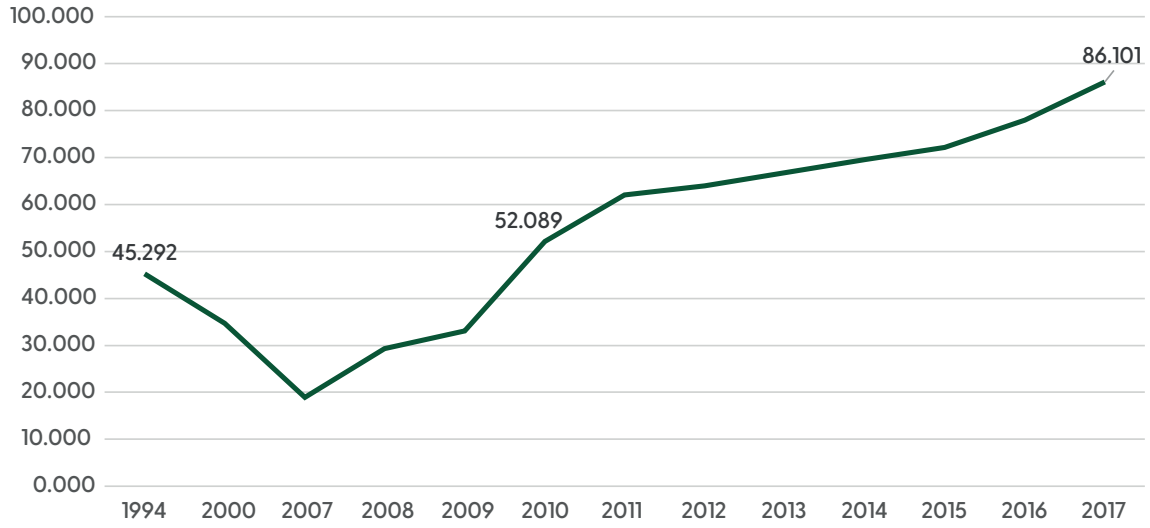
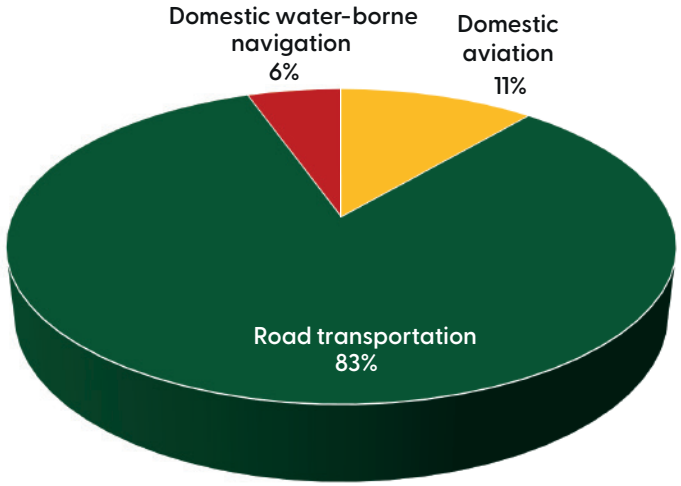


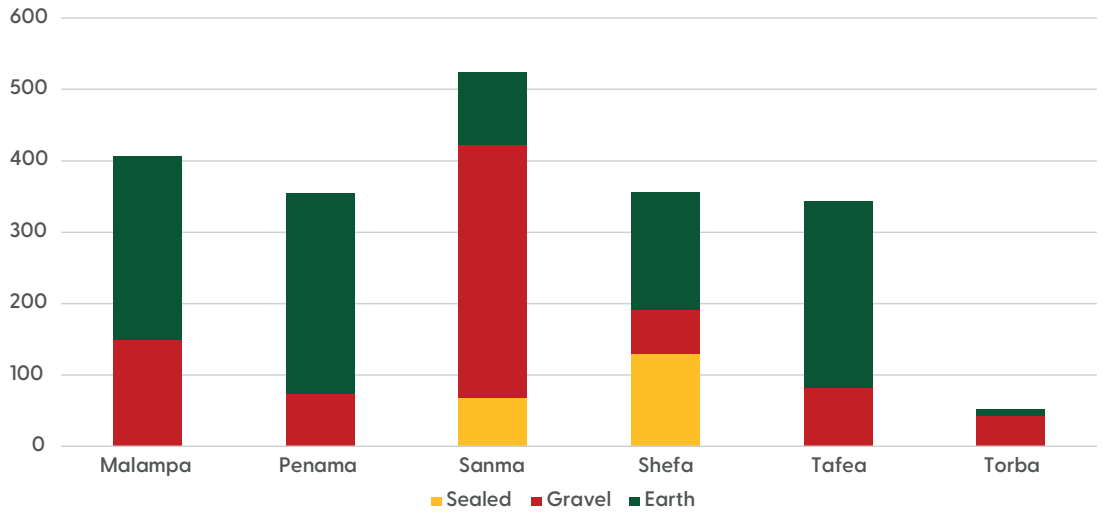
Figure 20: Transport sector fuel consumption and share of GHG emissions (2010-2015)



As Figure 20 shows, within the transport subsector, road transport's 83 percent share of total fuel consumption and GHG emissions is highest, followed by domestic aviation (11 percent) and domestic water-borne navigation (6 percent).

Road transportation: Road transportation in Vanuatu includes primarily public and private transport vehicles, such as cars, buses, motor bikes, pick-ups and trucks. Vanuatu has a limited road network (approximately 3,000 km) in rural and urban areas (sealed, gravel and earth) that are used as feeder and arterial roads and are managed by the PWD. However actual road network length is not known as the islands also include many local bush roads that the PWD does not maintain.

Figure 21: Vanuatu's road network



Efate, the most populated island, has a sealed ring road and other islands have limited link roads. However, the road network infrastructure is increasing and improving rapidly, thanks to development assistance and programmes.

The road transport sector is also important for the economy as it contributes approximately 4-5 percent of total government revenue annually through road taxes, vehicle licenses and vehicle import duties.

Although Vanuatu's road network is limited, the number of vehicles is growing rapidly. Vehicle registrations in Vanuatu grew by 6.2 percent/year between 2007-2016. This growth is expected to continue as road infrastructure, urbanization and incomes continue to grow. The growth in the number of new registered vehicles is particularly high for buses, cars and motor bikes, which grew at annual rates of 9.66 percent, 4.77 percent and 1.62 percent, respectively, between 2007-2016.

Figure 22: Motor vehicle registration in Vanuatu

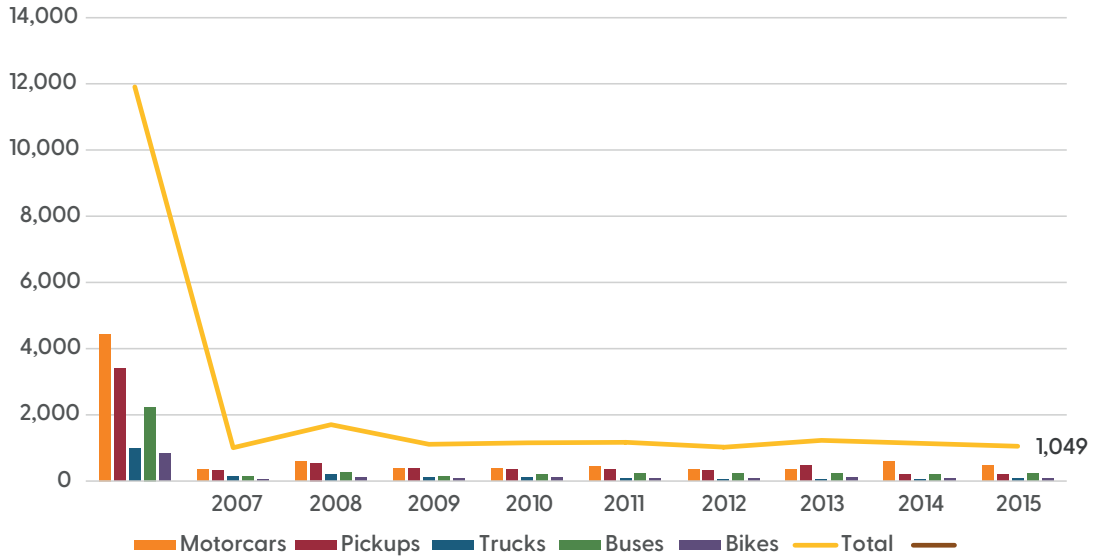
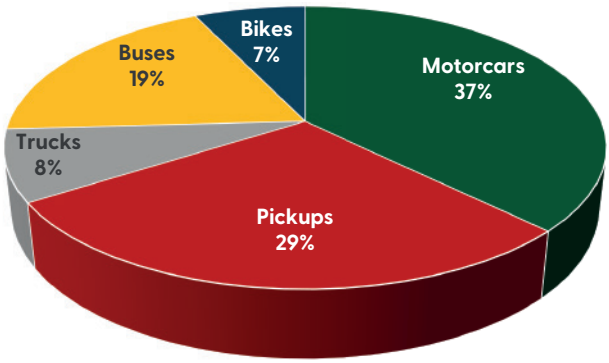


Figure 23: Motor vehicle registration by type of vehicle in Vanuatu (2007-2016)



The actual number of vehicles operating in Vanuatu is not known as a comprehensive vehicular database is not available. New vehicles registered in different years by the customs department are reported on a quarterly/annual basis and the number of vehicles removed from the roads is unknown. Public transport vehicles include primarily minibuses and taxis.

The number of vehicles in Vanuatu will likely increase in the future due to increased economic activity, GDP, per capita income and overall transport infrastructure. The estimated cumulative new vehicles will reach over 25,000 in 2025 and over 32,000 by year 2030, compared to just around 5,000 in 2010. Diesel and gasoline (petrol) consumption are likely to increase by 227 percent and 147 percent, respectively, compared to 2010. In addition, overall GHG emissions from the transport sector are estimated to reach 87.81 Gg CO_{2e} in 2025 and 98.60 Gg CO_{2e} in 2030.

NDC Action 3 (Existing measure 3): Improve transport (land and marine) energy efficiency

The NERM 2016-2030 identifies road transportation as an important mitigation sector. The overall mitigation action identified is to improve energy efficiency with new efficient vehicles, improved maintenance, behavior change and improved road infrastructure.

Table 8: Road transport sector target under NERM

National Energy Road Map (NERM Indicators)	Target-2020	Target-2030
Indicator 8: Improve transport (land and marine) energy efficiency	2%	10%

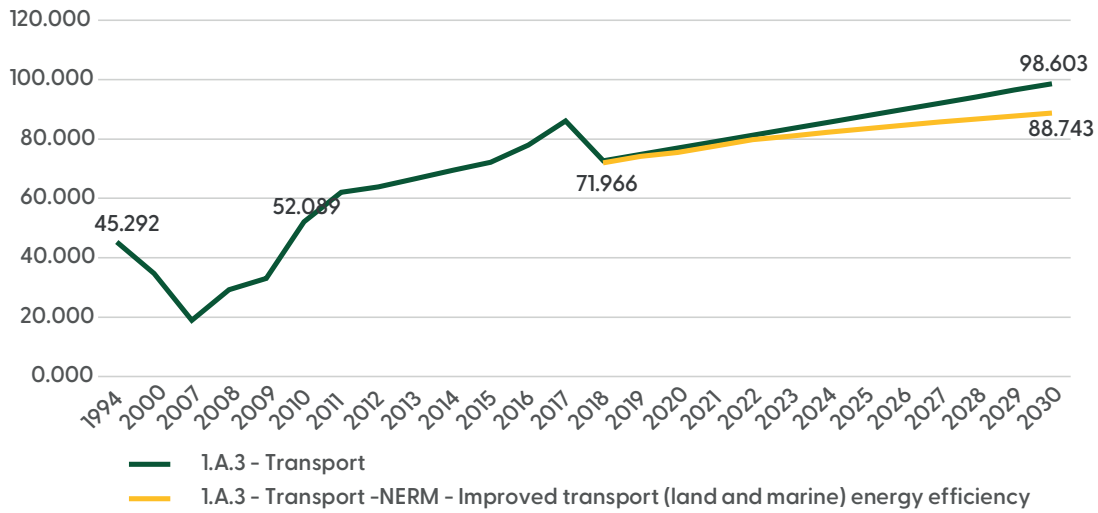
Implementing the NERM actions above are estimated to reduce emissions by about 31.32 Gg tCO_{2e} by 2025 and 36.654 Gg tCO_{2e} by 2030.

6.1.3.1 Transport subsector - emissions scenario

GHG emissions scenarios have been developed for the road transport subsector for 2010-2030. These scenarios are based on historical emissions and the cumulative impact expected due to NERM implementation.

- **BAU scenario or WOM:** Under the BAU or no action (WOM) scenario, GHG emissions from the subsector are expected to reach 87.808 Gg CO_{2e} in 2025 and 98.603 Gg CO_{2e} in 2030, compared to 2010 emissions of 52.809 Gg CO_{2e}.
- **NDC scenario or WEM:** under the existing NDC (WEM scenario or WM), subsector emissions are expected to reduce GHG emissions by 2 percent by 2025 and by 10 percent by 2030.

Figure 24: Transport subsector/GHG emissions scenario (Gg CO_{2eq})



The existing NDC transport sector commitment (increased energy efficiency in the transport sector/ road and marine) reduced GHG emissions from this subsector by nearly 10 percent in 2030. In addition, the transport subsector targets could be enhanced by introducing electric vehicles (EVs) and e-mobility in Vanuatu and achieving additional energy efficiency by introducing fuel blending (use of biodiesel).

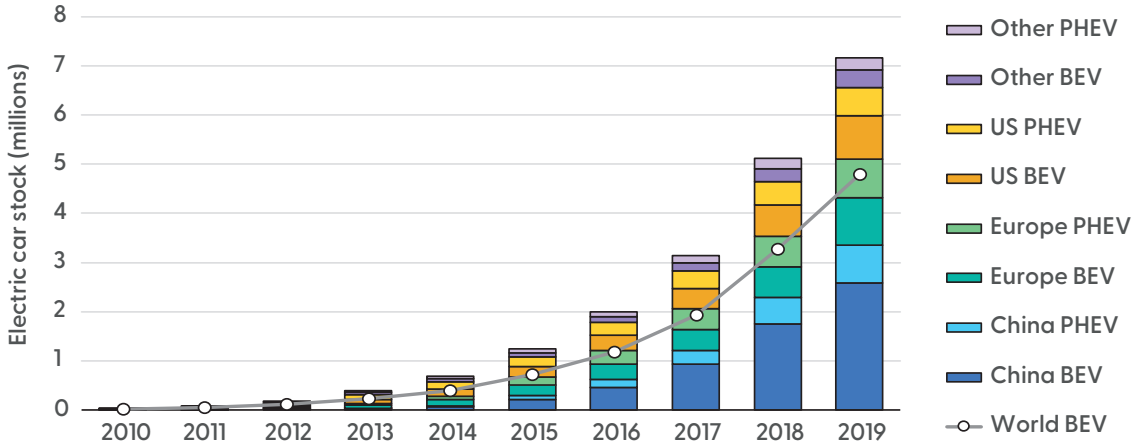
Additional NDC measure - Electric vehicles (e-mobility)

In addition to the existing NDC transport sector measures, potential exists to introduce EVs in Vanuatu. No EVs are currently registered in the country, although globally, e-mobility is expanding significantly as an alternative to conventional fossil fuel-based transportation systems.

The International Energy Agency's Global EV Outlook-2019 reported that sales of electric cars topped 2.1 million globally in 2019. The number of electric cars on the roads totaled 7.2 million that year, compared to just 17,000 in 2010. Global trends also indicate that the EV market share will increase dramatically, particularly after the mid-2020s when price parity will likely be achieved between EVs and internal combustion engines in most segments.

The agency's Sustainable Development Scenario suggests that the global EV stock (excluding two/three-wheelers) will grow by 36 percent annually, reaching 245 million vehicles in 2030, or more than 30 times the number today.

Figure 25: Global electric car stock (2010-2019)



Source: IEA, Global electric car stock, 2010-2019, IEA, Paris https://www.iea.org/data-and-statistics/charts/global-electric-car-stock-2010-2019

Apart from private EVs (two-wheelers and cars), other EVs (buses, taxis, three-wheelers and automobiles) are becoming the important and preferred mode for public transportation in urban areas. In Vanuatu, buses and taxis have dominated public transportation services operated by the private sector. EVs could be introduced into that system in the main populated areas of Port Vila and Luganville. Further, personal transportation in Port Vila has focused much more on cars and minibus options, so electrified transport may be even more feasible.

The advantage of introducing EVs is that Vanuatu is progressing well in terms of increasing the penetration of renewable energy (solar) systems on the Efate grid. Connecting EVs to the grid would help with the storage problem and would support effective and efficient grid management. The tariff for charging EVs could also be reduced if vehicles are charged when there is an excess of solar availability and the vehicles could sell electricity back to the grid at times of shortage. Apart from the benefit to the power system, small electric public transportation modes (including battery rickshaws and automobiles) can reduce traffic congestion in the Port Villa area and reduce pollution there.

The commercial viability of EVs is increasing rapidly, and appropriate government policies and support can further enhance public and private sector interest in them. International experience also suggests that government policies and incentives can play an important role in accelerating both demand and supply of EVs.

The GoV could promote e-mobility in the country by putting in place appropriate policies and plans.

The additional GHG mitigation measure proposed under the enhanced NDC scenario is to introduce EVs in Vanuatu for both public and private sector transportation.

Additional NDC measure 1.1 – Electric vehicles (e-buses) for public transportation (10 percent of total public buses)

Buses represented approximately 19 percent of new vehicles registered in Vanuatu between 2007-2016; that number is expected to increase in the future. The estimated cumulative number of buses could reach over 4,700 by 2025 and over 6,300 by 2030. Considering that, overall, it is appropriate to introduce e-buses for public transport in Vanuatu, the initial recommendation is to shift to 10 percent of e-buses, i.e., approximately 33 buses by 2030, with supportive legislation and policies. Based on the results and outcome of a pilot phase, the initiative could be scaled up with revised targets in a 2025 NDC update.

Additional NDC measure 1.2 – Electric cars (e-Cars) in Vanuatu (10 percent of government fleet)

Cars represent around 48 percent of total vehicles registered annually. The estimated cumulative number could reach over 11,500 by 2025 and over 15,700 by 2030. Electric cars could be a potential land transport mitigation measure in Vanuatu. Considering affordability and electric infrastructure required for charging, electric cars should be introduced first into the government fleet (based in the Port Vila and Luganville grid-connected areas). Based on the results and outcome of a trial, the initiative could be scaled up to include private cars with revised targets in a 2025 NDC update.

Additional NDC measure 1.3 – 1,000 electric two-wheelers (e-bikes)/three-wheelers (e-rickshaws)

Vanuatu has a much smaller number of two-wheeled vehicles (about 4 percent). Given the difficult terrain and poor road infrastructure, cars and buses are the country's preferred mode of transportation. However, experience in other island countries suggests that there is an opportunity to introduce electric bikes in Vanuatu (mostly in urban areas).

Electric three-wheelers and rickshaws for urban public transportation also provide a low-carbon transport option. Currently, buses are the only mode of transportation in urban areas, but with supporting policies and technology, the private sector could be encouraged to implement battery-operated three-wheelers. Under this measure, approximately 1,000 electric bikes/e-rickshaws could be added in Vanuatu by 2030.

A detailed assessment will be required to assess the feasibility and appropriateness of various type of EVs, as will policy and infrastructure requirements for introducing e-vehicles.

Additional GHG mitigation measures proposed under the transportation sector include:

Additional NDC measure 2 – 20 percent biodiesel (biofuel) blending in diesel

Road transportation vehicles could use a certain percentage of biodiesel. Biodiesel can be manufactured from copra oil and used in internal combustion engines. Some pilot biodiesel blending projects have been carried out in the Pacific (in Samoa) and this can be explored further as a potential GHG mitigation option. However, the economic value and price volatility of copra oil poses a major challenge. Detailed research and techno-economic feasibility studies will be required to explore this option. Further, under the current NDC, Vanuatu has an ambitious plan to use coconut oil to generate electricity, so demand and supply scenarios should be assessed prior to considering the biodiesel option.

Additional NDC measure 3 – Vehicle mileage and emission standards

All road transport vehicles are imported in Vanuatu. However, imported vehicles are not currently subject to mileage and emission standards. 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. Refurbished vehicles are being exported (from developed countries with stringent emission and mileage norms) to the PICs, so it would be appropriate to adopt specific mileage norms and tailgate exhaust standards. Further, improvements in the physical infrastructure of the road network and traffic systems would eventually increase road transportation vehicle mileage.

Aviation: Aviation is critical to Vanuatu's economy, providing essential transport links for tourism, trade, and disaster response and recovery. Vanuatu has three international airports: Bauerfield Airport-Port Vila (Efate); Pekoa Airport-Luganville (Espirito Santo); and White Grass Airport-Whitesands (Tanna) along with other 26 outer Island airports and airstrips. The aviation sector is still nascent and has yet to achieve its potential, due primarily to economical and geographical reasons.

The existing NDC has no targets specific to the aviation sector. However, those defined under the energy sector for energy efficiency and application of renewable energy apply to aviation as well.

Water-borne navigation: As an island nation, Vanuatu depends highly on water-borne navigation for domestic and international trade, tourism, and transportation. The effectiveness and efficiency of water transport, both international and inter-island shipping, are highly correlated to Vanuatu's economic development level. However, remote communities on the outer islands lack reliable, consistent and frequent shipping services.

Vanuatu has two international wharves in Port Vila and Espiritu Santo and public wharves and jetties for inter-island operations. Three main passenger vessels provide less expensive transport among three of the major populated islands:

(1) Vanuatu Ferry, which also carries cargo, travels between Port Vila, Santo, Malekula and Tanna; (2) Vanuatu Cargo, the Vanuatu Ferry's sister ship; and (3) The Big Sista. These ships also continue through and service the more populated islands. Some of the smaller cargo vessels can carry up to five passengers but are not designed for passenger transport.

Diesel oil and gasoline/petrol are the main fuels used for water-borne navigation. Most inter-island shipping services are privately owned and operated (mainly Vanuatu Ferry and Big Sista), generally by single ship owners. Shipping operators set fees and charges to carry passengers and freight based on the cost of operations. For financial reasons, they must often migrate to routes with sufficient passenger and cargo volumes to maintain commercial viability or reduce the frequency of ship calls to build demand. Further, management and technical expertise in the domestic shipping industry is limited, which makes operations less efficient and increases fuel consumption and GHG emissions.

The existing NDC has no targets specific to the domestic water-borne navigation/shipping/marine transportation sector. However, the targets defined under the road transport sector - improve transport (land and marine) energy efficiency (NERM-Indicator 8) and the additional proposed NDC measure to blend 2–20 percent biodiesel (biofuel) in diesel – offer mitigation benefits. Additionally, improving the physical infrastructure of ports and jetties will also increase the efficiency of water-borne navigation and help reduce fossil fuel consumption.

6.1.4 OTHER SUBSECTORS

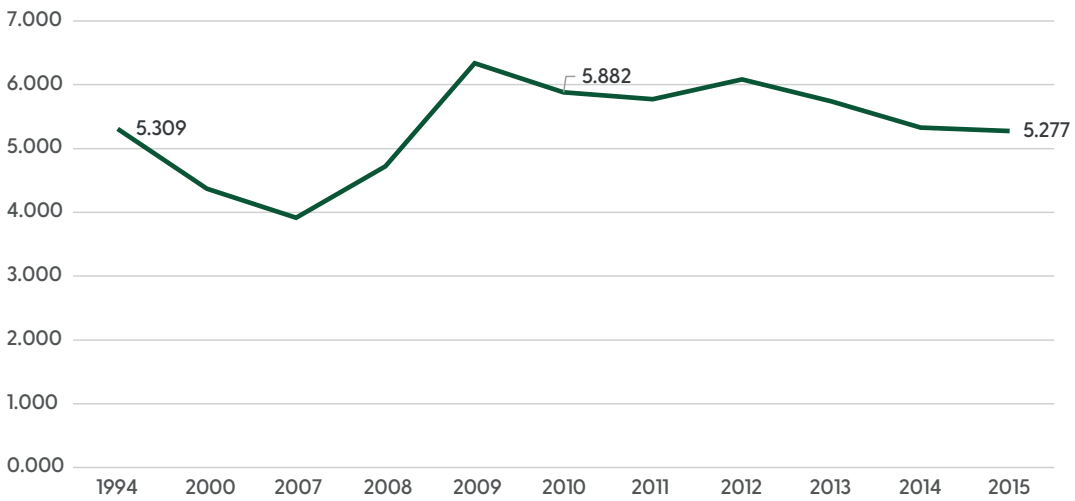
Other subsectors under the energy sector include direct fuel consumption, primarily in commercial, institutional, residential and any other uncategorized and unorganized sectors or for any other purposes. This includes hotels, tourism bungalows, guest houses, restaurants, retail and shopping complexes. The other subsectors under the energy sector contribute around 0.98 percent of total GHG emissions and consume about 2.5 percent of total fossil fuel (mainly kerosene, LPG, diesel and petrol) imported into Vanuatu.

This subsector is the leading consumer of LPG imported into Vanuatu, primarily for commercial and domestic cooking; annual domestic demand for LPG totals approximately 3 million litres. Other fuels (diesel, petrol and kerosene) are used primarily for lighting and electricity generation in off-grid areas, and are used on a limited basis in grid-connected areas due to reliability and availability constraints.

Mostly rural (and some urban) households use biomass as their primary source of energy, mainly for cooking, with approximately 85 percent of households using wood and coconut shells. However, little accurate information is available on biomass produced and utilized in Vanuatu.

Total GHG emissions from the other subsectors total 5.882 Gg CO_{2e} and 5.227 Gg CO_{2e} for 2010 and 2015, respectively. Figure 26 presents historical GHG emissions from manufacturing industries and the construction subsector.

Figure 26: GHG emissions from other subsectors (Gg CO_{2eq})



The NERM 2016-2030 identifies these other subsectors as important sources of GHG emissions, and notes specific mitigation actions that primarily involve improving energy access among off-grid rural households, energy efficiency in domestic and commercial cooking, and energy efficiency in the building sector, and increasing the use of renewable energy in other sectors.

Table 9: Other sector targets under NERM

National Energy Road Map (NERM indicators)	Target -2020	Target -2030
Indicator 2: Increase electricity access among households in off-grid areas	100%	100%
Indicator 3: Increase electricity access by public institutions (on- and off-grid)	80%	100%
Indicator 6: Increase the proportion of electricity generated from renewable energy sources	65%	100%
Indicator 7: Improve electricity sector end-use efficiency	5%	13%
Indicator 9: Improve biomass end use efficiency (improved cook stoves and drying)	5%	14%
Indicator 12: Increase renewable electricity use by rural tourism bungalows	25%	65%

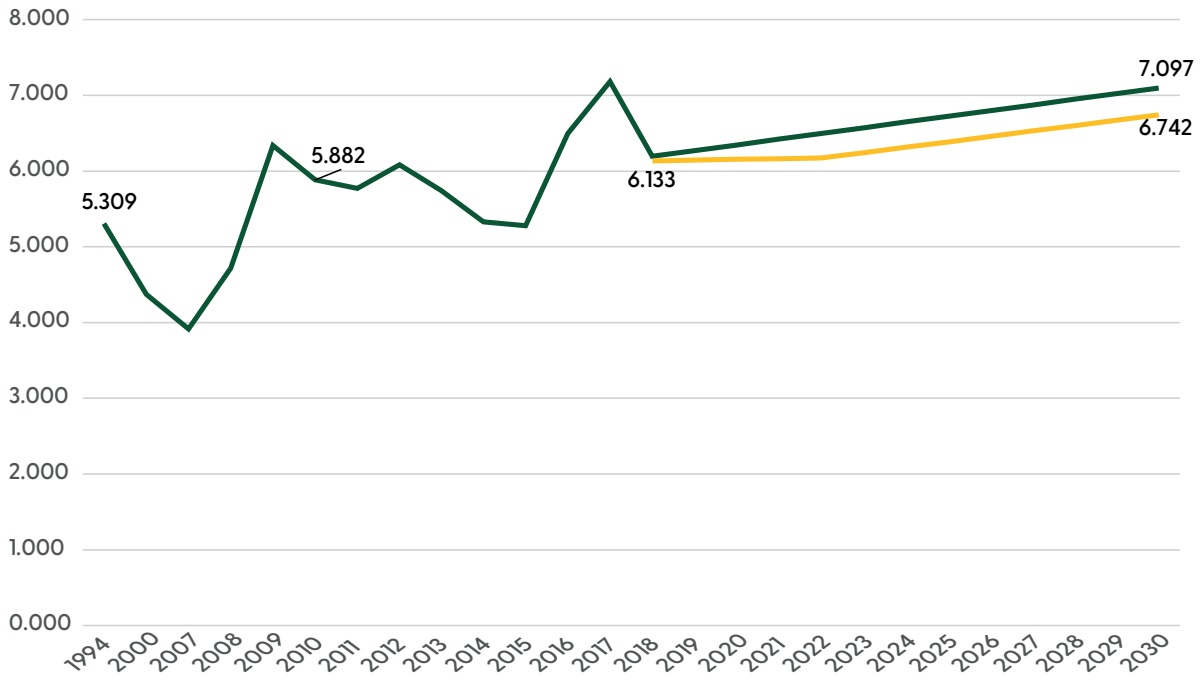
The measures listed above are in various stages of implementation and are included in the energy sector GHG emissions scenario analysis (see earlier section).

Other subsectors - emissions scenario

A GHG emissions scenario has been developed for other subsectors (residential, commercial and others) for 2010-2030.

- **BAU scenario or WOM:** Under the BAU or no action (WOM) scenario, GHG emissions from this subsector are expected to reach 6.721 Gg CO_{2e} in 2025 and 7.097 Gg CO_{2e} in 2030, compared to 2010 emissions of 5.882 Gg CO_{2e}.
- **NDC scenario or WEM:** under the existing NDC (WEM or WM scenario), sub sectoral emissions are expected to reduce GHG emissions from BAU by 5 percent by 2030.

Figure 27: Other sectors - GHG emissions scenario (Gg CO_{2eq})



The existing NDC includes targets for other subsectors (refer to Table 9), leading to GHG emissions reductions of nearly 5 percent by 2030.

The additional measures with mitigation potential recommended under the enhanced NDC scenario are:

Additional NDC measure 4 – Biogas plants for commercial and residential use (1,000 plants)

Building biogas plants for commercial and residential use would be an important GHG mitigation measure for Vanuatu. The conversion of organic/degradable materials (usually manure, food, agricultural waste and other bio-degradable waste) to burnable methane through biogas digesters has been used, mostly for cooking, with varying levels of success in the Pacific. Vanuatu has already implemented pilot institutional scale biogas plants (100kg/day of waste) at Onesua Presbyterian College and Vanuatu Agricultural College using food and piggery waste and they have been operating efficiently during the past few years.

Potential exists for household and additional institutional-scale biogas plants to meet energy needs for cooking in Vanuatu. The NERM 2016-2030 priorities also include the promotion of efficient cookstoves and modern cooking fuels (such as LPG or biogas) under objective 2: Extend access to modern cooking fuels and cooking technologies.

Biogas plants would also help reduce GHG emissions from the livestock sector via modern management of livestock waste. The key technical problem involves collecting large quantities of manure and maintaining the conditions (such as temperature and water content) in the biogas digester required to produce gas. In addition, a large number of animals (pig and cows) must be confined to reduce the cost of collecting manure. A detailed techno-economic feasibility assessment study should be conducted to further explore the opportunities for this GHG abatement measure.

Additional NDC measure 5 – Energy efficiency in the commercial and residential sector

- ***Additional NDC measure 5.1 – increase energy efficiency by 5 percent in the commercial and residential sector***
- ***Additional NDC measure 5.2 – Convert/design 10 buildings to be energy efficient (green buildings)***

Energy efficiency (particularly in the commercial and residential sector) is an important GHG mitigation measure and may be considered as an additional NDC action. The DoE has already initiated various measures to enhance energy efficiency across the demand-side sectors. The goal is to implement energy efficiency measures, to be pursued across the board, to achieve 15 percent energy savings. In addition, energy labelling for select electric equipment is already in place in Vanuatu. The incremental improvement in energy efficiency and improvements in electricity consumption standards will help to reduce GHG emissions. A detailed energy efficiency plan will be prepared to quantify the mitigation benefits from energy efficiency.

The construction sector represents another important aspect of energy efficiency, as energy/resource efficiency can be central to building design and construction. Significant energy savings can be achieved during construction and operational lifetime using green building design and passive design concepts. The green building concept can be introduced to existing and new buildings, starting with government buildings and donor-funded infrastructure.

Additional NDC measure (CE strategy 3.15): Ecotourism supported by local communities

Vanuatu has adopted a sustainable tourism policy that aims to minimize waste and GHG emissions from tourism and to target responsible and high-value tourists who can help enhance and conserve the country's environmental and cultural resources. Vanuatu has important and valuable experiences to share

with visitors, including adopting a low-carbon lifestyle and the value of protecting natural resources, which are the basis of tourism there. Through ecotourism, Vanuatu might inspire visitors to bring home inspiring lessons on lifestyle change. Other targets that could support ecotourism might focus on sourcing locally-produced food. An estimated 27 percent of tourism revenues are used to procure goods and services from abroad. Given the long transport distances to Vanuatu, local production tends to have a lower carbon footprint, use less packaging and support local communities.

Emphasizing ecotourism means targeting 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. By positioning Vanuatu as a country that has made fundamentally different development choices, rather than one that has failed to make progress on a conventional development pathway, the country can stand out, with dignity, as a destination. The following actions could encourage ecotourism:

1. Establish collaboration between farms and the tourism sector to increase the use of local food products;

2. Adopt minimum standards for tourism operations, perhaps following guidance from the Sustainable Tourism Stewardship Council. These standards could be included in the process of obtaining a license for tourist operations or an ecotourism certificate;

3. Implement a green tax on tourism, which would collect revenue from tour operators to pay for the ecosystem services that attract tourists. This tax could be levied on hotel rooms;[18]

4. Encourage tourism companies to adopt green building standards that rely on domestic construction materials and construction traditions. This could also be part of the process of obtaining an ecotourism certificate; and,

5. Prioritize local products to reduce plastic waste from tourism. Those wastes have an impact on natural assets and marine litter reduces the country's tourist appeal.

Estimating the impact of prioritizing local products in the tourism sector requires more information on the volume and type of imported products that local products can replace and on the impact of enforcing green building standards for hotels and resorts.

6.1.5 ANALYSIS OF GHG EMISSIONS SCENARIOS (WITH EXISTING AND ADDITIONAL MEASURES)[19]

6.1.5.1 Energy sector - GHG emissions scenario

A GHG emissions scenario has been developed for the energy sector, including the subsectors discussed above, using the applicable guidance for estimating projected GHG emissions (UNFCCC, 2004, 2016 and DG CLIMA, 2012). The emissions scenarios are based on historical emissions, with projections for 2010-2030 made using the statistical model. Three scenarios have been developed:

- **BAU scenario or WOM:** Assessment based on what might happen if Vanuatu takes (or has taken) no action (WOM).

- **NDC scenario or WEM:** Assessment based on what might be achieved with the actions that Vanuatu is committed to take under the existing NDC (WEM or, sometimes, simply known as WM). The mitigation measures identified for the energy subsectors under the NERM 2016-2030 have also been incorporated. Table 10 presents the consolidated NERM 2016-2030 mitigation measures.

18 UNESCAP (2012), 'Green Economy in a Blue World Pacific Perspectives 2012,' available from: https://www.unescap.org/resources/green-economy-blue-world-pacific-perspective-2012.
19 Data modelling and analysis of Vanuatu's GHG emission scenarios for Vanuatu's NDC update (2020)

Table 10: Energy sector targets under NERM and current NDC actions

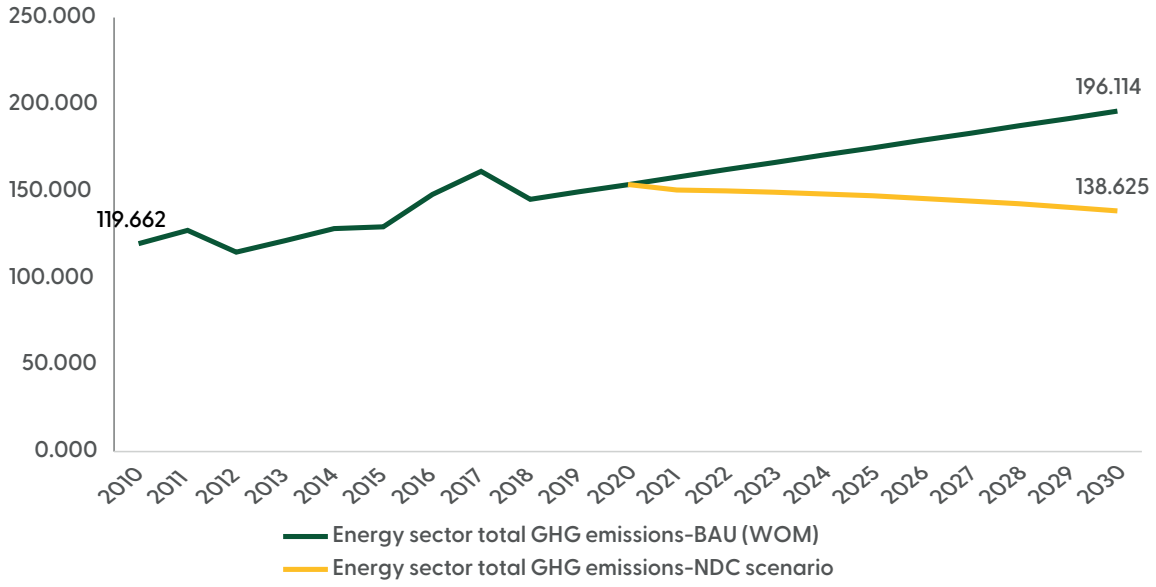
National Energy Road Map (NERM indicators)	2020 Target	2030 Target-
Indicator 1: Increase electricity access by households in concession areas	75%	100%
Indicator 2: Increase electricity access by households in off-grid areas	100%	100%
Indicator 3: Increase electricity access by public institutions (on- and off-grid)	80%	100%
Indicator 4: Improve the efficiency of diesel generation	20%	20%
Indicator 6: Increase the proportion of electricity generated from renewable energy sources	65%	100%
Indicator 7: Improve electricity sector end-use efficiency	5%	13%
Indicator 8: Improve transport (land and marine) energy efficiency	2%	10%
Indicator 9: Improve biomass end use (improved cook stoves and drying) efficiency	5%	14%
Indicator 11: Increase the proportion of electricity generated from biofuels	10%	14%
Indicator 12: Increase renewable electricity use by rural tourism bungalows	25%	65%
Specific current NDC actions		
NDC Action 1 (Existing measure 1): Renewable energy capacity addition		
NDC Action 2 (Existing measure 2): Substitute and/or replacement fossil fuels with coconut (copra) oil-based electricity generation		
GHG emissions form the electricity subsector is expected to be reduced by 100 percent and in the energy sector as whole by 30 percent		

The BAU (WOM) and NDC scenarios (WEM) have been assessed using historical data and projections for 2030. Thus, the same set of data used for the BAU scenario, NDC scenario and projection estimates reflect the impacts of other relevant actions on GHG emissions. However, emission projections are indicative only because of varied assumptions (including GDP growth, population, electrification rate, transport and technology uptake).

Table 11: Energy sector GHG emissions scenarios (2010-2030)

Categories	2010	2015	2020 (est.)	2025 (est.)	2030 (est.)
BAU scenario or WOM - Gg tCO_{2e}	119.662	129.550	153.842	174.978	196.114
NDC scenario or WEM - Gg tCO_{2e}	119.662	129.550	145.864	138.270	123.433

Figure 28: Energy sector GHG emissions scenario (2030) (Gg CO_{2eq})



The graph presents the estimated net GHG emissions (tCO_{2e}) from Vanuatu under both the BAU and NDC scenarios, based on historical data and projections to 2030.

Net GHG emissions from Vanuatu's energy sector totaled 119.662 $GgCO_{2e}$ in 2010. Under the BAU scenario, energy sector emissions are estimated to reach 196.114 $GgCO_{2e}$ by 2030. With existing NDC measures (energy sector measures), they are estimated to fall to 123.433 $GgCO_{2e}$, or by approximately 37 percent as compared to the BAU scenario. Further, in line with existing NDC measures (including the NERM 2016-2030), Vanuatu expects to eliminate all GHG emissions from the electricity generation subsector and reduce total GHG energy sector emissions by more than 30 percent by 2030.

Enhanced NDC scenario or WAM: Assessment based on additional measures identified and to be included as enhanced NDC actions, i.e., what else Vanuatu could do to further enhance its climate change-related ambitions (WAM).

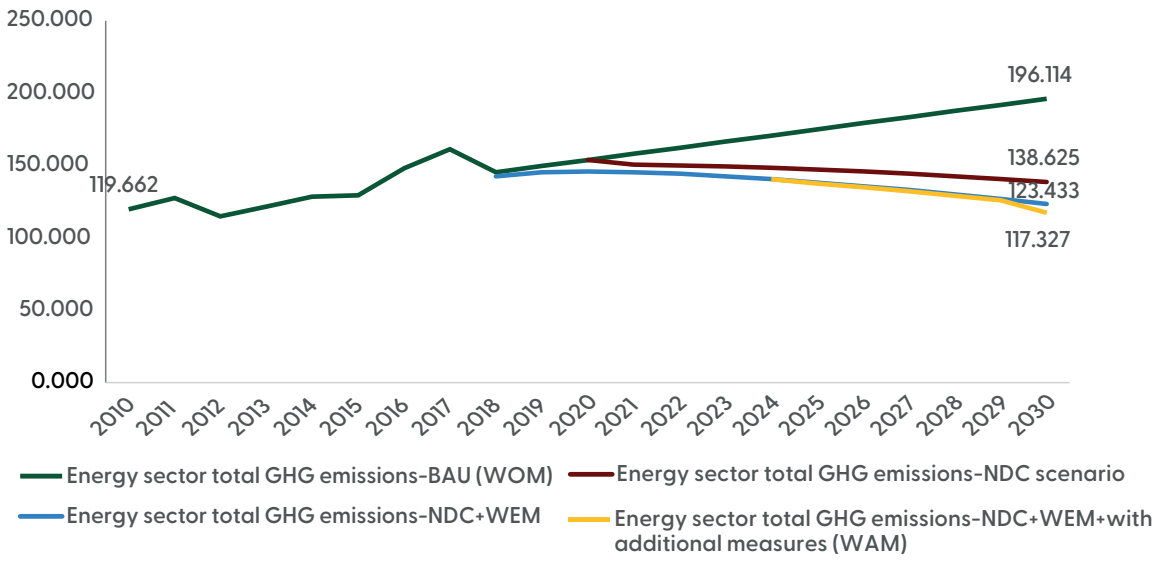
Table 12 presents the additional measures recommended for the energy sector, including the subsectors.

Table 12: Additional NDC energy sector measures for 2030 (proposed actions)

Enhanced NDC energy sector recommended actions

Transport	
Additional NDC measure 1	Electric vehicles (e-mobility)
Additional NDC measure 1.1	Electric vehicles (e-buses) for public transportation (10% of total public buses)
Additional NDC measure 1.2	Electric cars (e-Cars) in Vanuatu (10% of government fleet)
Additional NDC measure 1.3	1,000 electric Two (e-bikes)/three-wheelers (e-rickshaw)
Additional NDC measure 2	20% biodiesel (biofuel) blending in diesel
Additional NDC measure 3	Mileage and vehicle emissions standards
Other sectors	
Additional NDC measure 4	Biogas plants for commercial and residential use (1,000 biogas plants)
Additional NDC measure 5	Energy efficiency in commercial and residential sector
Additional NDC measure 5.1	Increase energy efficiency in commercial and residential sector by 5%
Additional NDC measure 5.2	Convert/design 10 buildings to be energy efficient (green buildings)
Additional NDC measure (CE strategy 3.15)	Ecotourism supported by local communities

Figure 29: Energy sector GHG emissions scenario with additional measures (2030) (Gg CO_{2eq})



The energy sector GHG scenario analysis shows the following:

- **GHG emissions under BAU scenario or WOM:** Under the BAU scenario, net energy sector GHG emissions (CO_{2eq}) would reach 196.114 Gg in 2030.
- **GHG emissions under existing NDC scenario or WEM:** Net energy sector GHG emissions (CO_{2eq}) with existing NDC measures and other measures included in NERM would total approximately 123.433 Gg in 2030, or about 37 percent (72.681 Gg CO_{2e}) less than under the BAU scenario.
- **GHG emissions under enhanced NDC scenario or WAM:** Net energy sector GHG emissions (CO_{2eq}) would total approximately 117.327 Gg CO_{2eq} in 2030 with additional measures identified under the enhanced NDC scenario, or about 40 percent (78.786 Gg CO2e) less than under the BAU scenario. The additional enhanced NDC measures would achieve an additional 6.106 Gg CO2eq emissions reduction from the energy sector.

6.2 INDUSTRIAL PROCESSES AND PRODUCT USE (IPPU)

The IPPU sector covers GHG emissions from industrial processes as an output of non-energy related activities. In Vanuatu, this sector is virtually non-existent due to the absence of any major industry or industrial process activities. It also covers emissions from solvents and other products containing volatile compounds (primarily non-methane volatile organic compounds). Vanuatu does not import any solvents, refrigerants or ozone- depleting substances (ODS) directly, except for a small amount of refrigerant and ODS used in air conditioning and refrigeration equipment only.

The current NDC update does not include any IPPU sector mitigation measures or recommended actions.

6.3 AGRICULTURE, FORESTRY, AND OTHER LAND USE (AFOLU)

Vanuatu's agriculture (livestock) subsector is the major contributor of methane emissions and the leading contributor of GHG emissions within the AFOLU sector. On the other hand, the forestry sector is a net carbon sink; as a result, Vanuatu's net carbon emissions are negative. The AFOLU sector assessment and potential mitigation actions include:

6.3.1 AGRICULTURE

Vanuatu has a very small agriculture sector. Farming activities are limited to subsistence farming, kitchen gardens, and mainly fruit and vegetable cultivation. In the absence of any major crop cultivation, rice cultivation or any chemical fertilizer use, this subsector does not produce any GHG emissions and is thus not considered under the NDC.

6.3.1.1 Livestock

Livestock are an integral part of the country's farming systems and essential to the livelihoods of a vast majority of Vanuatuans. The sector plays an important role in local cultures and the country's economic development. The livestock subsector is the major contributor of methane emissions and the leading contributor of GHG emissions. The main livestock animals include cattle, poultry (chickens) and pigs. Vanuatu is known as the Pacific's largest and best beef producer and exporter. Figure 30 presents the category-wise livestock population.

Livestock enteric fermentation (due to the digestive system of ruminant animals like cattle, buffalo, sheep and goats) and the manure management system are the primary sources of GHG emissions. Cattle account for the majority of methane emissions in this category.

Vanuatu's subtropical environment is well suited to and provides a conducive environment for cattle farming. This has resulted in significant growth in the number of cattle since 1994 and, thus, a significant source of GHG emissions.

The Ministry of Agriculture Livestock Fisheries Forests and Bio Security (MALFFB) is pursuing initiatives to increase the country's livestock population, considering beef an important export commodity, source of revenue and key food source.

Figure 30: Livestock category and population (2007-2017)

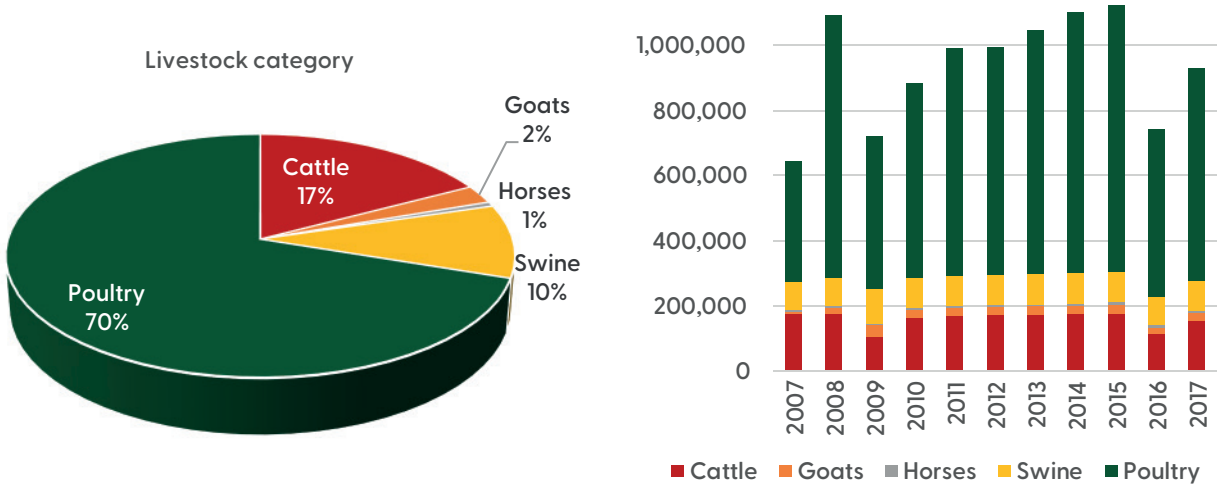
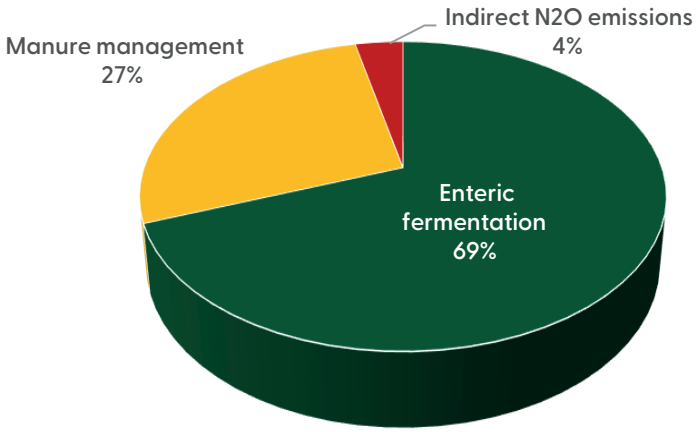


Figure 31: AFOLU sector share of GHG emissions



Given the lack of systematic livestock farming practices, the livestock subsector produces higher emissions and it is difficult to implement GHG mitigation measures. In addition, the islands' remoteness, the livestock farmers' limited capacity, limited availability of technological and financial support, and cultural and social practices create challenges to introducing modern scientific ruminant and pasture management practices.

MALFFB is working to increase the ni-Vanuatu population's capacity to improve livestock farming practices. Modern and scientific livestock farming and pasture management practices are expected to be implemented in due course. Although the livestock subsector is very important for Vanuatu and its economy, given the economic and political sensitivities, no specific NDC mitigation actions have been recommended apart from training and capacity-building.

Additional NDC measure 6 – Training and capacity-building for livestock farming and pasture management

With this enhanced NDC measure, MALFFB would be able to build livestock farmers' capacities in sustainable livestock farming practices, including creating access to suitable technological and providing economic support to improve pasture management practices. GHG emissions reduction from this additional measure is difficult to estimate; however, experience from other countries suggests the potential is between about 5 and 25 percent from the baseline scenario.

Additional NDC measure (CE strategy 3.1) - Converting pastures to silvopastoral livestock systems

Silvopastoral livestock systems combine forestry activities with livestock grazing. This intervention proposes to increase forest carbon by planting trees on grassland. This can increase livestock productivity, while dual use of land increases overall revenue per hectare. When converting grassland to silvopastoral livestock systems, additional carbon is sequestered in the trees. In addition to strengthening institutional capacity, the project has two main elements:

1. Introduce silvopastoral production systems for cattle ranching. This expands the range of environmental services offered by farmers related to biodiversity, land, carbon and water; and,

2. Reduce land degradation in participating farms through differentiated payments for environmental services. This includes introducing riparian and terrestrial corridors to improve connectivity between natural ecosystems and cattle farms.

As a next step in implementation, financial incentives could be introduced to convert grassland to silvopastoral systems. This could include payments for environmental services financed through the dual use of land and increased productivity of livestock farming.

Where pastures are maintained, the restoration of degraded grasslands can help increase soil organic carbon. Vanuatu has an estimated 11,473 hectares of grasslands. Switching to a silvopastoral system, following Colombia's example, could sequester 2.7 tons of CO_{2e} per hectare, or about 30.977 Gg CO_{2eq}/ year.

Additional NDC measure (CE strategy 3.14) - International collaboration to improve livestock efficiency

Even as Vanuatu's livestock sector pursues its growth goals, a low-carbon growth perspective must be maintained. Because it is difficult to reduce GHG emissions from livestock, international cooperation may help to identify viable options. Many climate mitigation investments target manure management by introducing biodigesters. This requires collecting manure, which is not done in Vanuatu as most livestock are free range. Another option is to combine forestry or plantation with cattle grazing. This is already practiced in Vanuatu, where cattle roam freely in coconut plantations and where coconut meal, a waste product, is used as a source of protein for them.

Still, given that beef and dairy production generates up to 60 percent of national GHG emissions, even a small reduction would cut those emissions significantly. The World Bank and FAO have identified measures that could be relevant in the Vanuatuan context.

The World Bank supported the adoption, by family farmers in Uruguay, of climate-smart livestock practices, which helped improve grazing areas, animal waste management in watersheds and carbon sequestration in grasslands. Similar programmes in Vietnam targeted over 23,000 household-based livestock farmers

and helped them reduce their environmental impact through livestock waste management, disease control and the provision of veterinary services. Costa Rica is analysing and developing the business case for low-carbon livestock, targeting the widespread adoption of climate-smart practices and technologies in the agriculture and livestock sectors. The FAO provides an overview of policy measures that can help expedite the transition to a low-carbon livestock sector. Their recommendations range from pricing externalities with a carbon tax (see intervention 3.5) to producer support programmes, such as the World Bank programmes mentioned above.

Steps toward a more circular meat value chains could include:

1. Training smallholder farmers to support productivity increases; for example, by enhanced feeding, improving animal health and welfare through disease prevention and veterinary services, improved pasture management and rotational grazing, perhaps supported with fencing from whitewood thinning.

2. Replacing mineral fertilizers with processed organic residues. Vanuatu imports around 70 tons of nitrogen fertilizer annually.

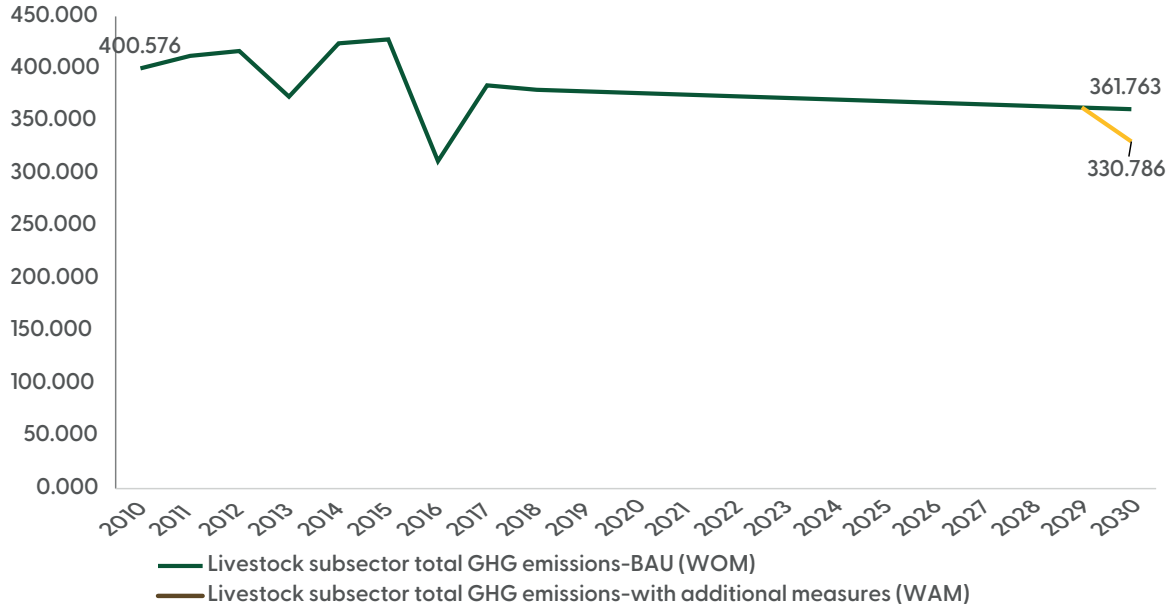
The GoV seeks to cooperate with New Zealand and other interested countries to find and develop ways to mitigate emissions through ruminant and pasture management. Data is lacking to quantify the potential and related impact of increased livestock productivity on GHG emissions.

Table 13 lists the additional energy sector recommended measures (including the subsectors).

Table 13: Additional NDC livestock subsector measures (proposed actions) (2030)

Enhanced NDC livestock subsector recommended actions	
Additional NDC measure 6	Training and capacity-building for livestock farming and pasture management
Additional NDC measure (CE strategy 3.1)	Converting pastures to silvopastoral livestock systems
Additional NDC measure (CE strategy 3.14)	International collaboration to improve livestock efficiency

Figure 32: Livestock subsector GHG emissions scenario with additional measures (2030) (Gg CO_{2eq})



The livestock subsector GHG scenario analysis shows the following:

- **GHG emissions under BAU scenario or WOM:** Net livestock subsector GHG emissions (CO_{2eq}) under the BAU scenario would reach 361.763 Gg in 2030.
- **GHG emissions under existing NDC scenario or WEM:** No mitigation actions were planned in the existing NDC, so emissions were expected to remain the same as under the BAU scenario.
- **GHG emissions under enhanced NDC scenario or WAM:** The livestock subsector's net GHG emissions (CO_{2eq}) would total approximately 330.786 Gg CO_{2eq} in 2030 with additional measures identified under the enhanced NDC scenario, or about 9 percent (30.977 Gg CO_{2e}) less than under the BAU scenario. (The GHG mitigation potentials for some of the additional enhanced NDC measures have not been estimated given the complexity of the data and lack of a defined methodology. However, the cumulative impact of the additional measures will produce greater GHG emission reductions.)

6.3.2 FOREST

Vanuatu's land area totals about 12,336km2, with more than 36.1 percent (440,000 hectares) covered by tropical forest. Another 4,800 hectares are covered with planted forests; about 3 percent of mid-to-high forests (about 6,000 hectares) and 0.7 percent of low forests (about 1,400 hectares) are in protected areas. Vanuatu's forests are also home to some 108 known species of amphibians, birds, mammals and reptiles and at least 870 species of vascular plants. The coastal region is also rich in sea life, with more than 4,000 species of marine molluscs.

Table 14: Forest cover in Vanuatu (2007-2015)

Total land area (hectares)	1,219,000	
Forest cover area (hectares)	440,000	36.3%
Other wooded land (hectares)	475,000	39.3%
Other land (hectares)	297,000	24.4%

Table 15: Forestry sector CO_2 removals (2007-2015)

	Annual increase in biomass carbon stocks due to biomass growth	Annual carbon loss due to biomass removals	Net annual carbon uptake (+) or release (-)	Conversion to CO_2 annual emission (-) or removal (+)
	(tons C/yr-1)	(tons C/yr-1)	(tons C/yr-1)	(Gg CO_2)
2007-2009	2,109,800	194,938.45	1,914,861.55	(+) 7,021.15
2010-2015	2,109,800	207,884.95	1,901,915.05	(+) 6,973.68

Although limited information is available on forest conversion or change in forest cover, discussions with the forest department and FAO data indicate that forest cover area has not changed significantly since 2000, including the GHG inventory for 2007-2015.

The forestry sector in Vanuatu is a net carbon sink. The prominence of carbon sequestration in the national GHG inventory reflects the mandate of the national forest policy, which considers forests crucial to the well-being of the ni-Vanuatu population to fulfil essential needs, such as obtaining wood, food, fodder and traditional remedies.

Further, sustainable commercial logging practices are practiced in Vanuatu. The country is also committed to maintaining its forest cover and is expected to remain net carbon negative in the future. The REDD+ programme is being implemented in Vanuatu to improve sustainable forest management practices.

No specific NDC actions have been recommended for the forestry subsector as the measures to reduce deforestation and promote good land care to accepted mitigation practices are still being developed under the REDD+ initiative. Based on the results and outcome of that initiative, potential mitigation interventions may be identified and included as revised targets in the 2025 NDC update.

6.4 WASTE SECTOR

Vanuatu's waste sector includes primarily solid waste and wastewater. GHG emissions from this sector come mainly from municipal solid waste disposal (excluding biological waste and industrial waste, which Vanuatu does not produce) and domestic and commercial wastewater discharge (industrial wastewater is generated). The main GHG emissions are methane (CH_4) and nitrous oxide (N_2O). Total 2010 waste sector emissions were estimated at 32.241 Gg CO_{2e} and totalled an estimated 37.275 Gg CO_{2e} in 2015.

6.4.1 MUNICIPAL SOLID WASTE (MSW)

Municipal solid waste (MSW) disposal in urban areas (Port Vila, Luganville and Lenakel) is a key source of GHG emissions in Vanuatu. Rural populations generate little or no waste due to their subsistence lifestyle. MSW sector emissions include primarily methane emissions from the anaerobic decomposition of MSW disposed at the Bouffa landfill site in Port Vila and the Luganville and Lenakel solid waste landfill sites. Further, open dumping of MSW and the lack of waste management practices have led to higher GHG emissions in Vanuatu. MSW disposal is responsible for about 5 percent of the country's total GHG emissions and 78 percent of total GHG emissions from the waste sector. It is one of the major concerns for the country.

Common methods of MSW disposal include open backyard dumpsites, disposal at sea or on unused land, and burning. However, the areas noted above have waste collection systems and the MSW collected is sent to landfill sites. In recent years, waste collection efficiency has increased throughout municipal areas, reaching around 90 percent in the cities. Figure 33 shows the urban population, MSW generation and MSW compositions.

Figure 33: Urban population and the composition of MSW in Vanuatu (2007-2015)

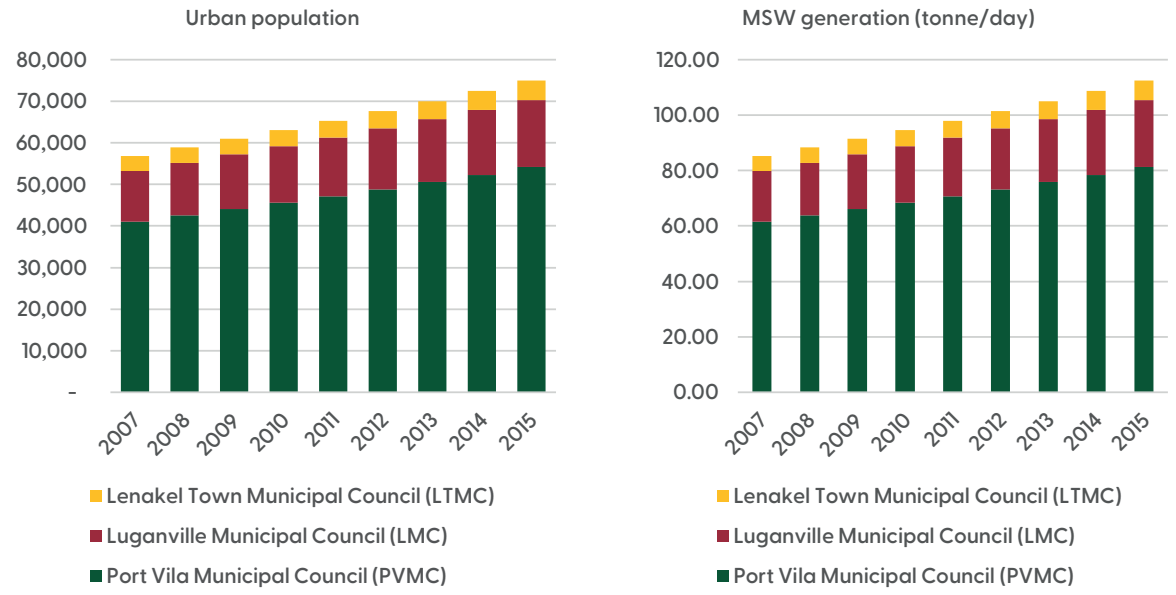
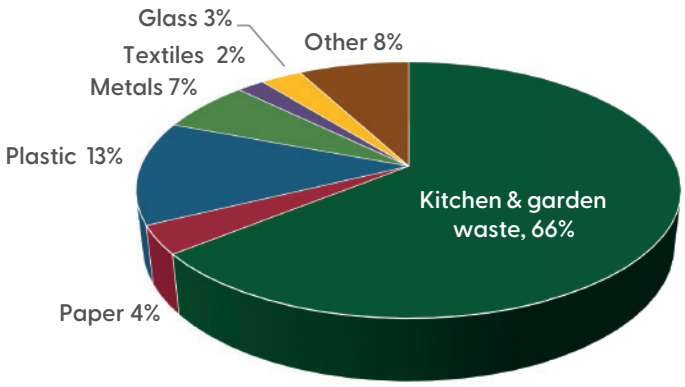


Figure 34: MSW composition (weight fraction)



The waste composition analysis suggests that a significant quantity of the MSW generated in the urban areas is biodegradable. Further rapid urbanization and population increase are expected to contribute to further increases in the overall amount of MSW generated. In the absence of any scientific waste management practices, GHG emissions from the waste sector will thus increase.

Additional NDC measure 7 – Waste-to-energy (WTE) plants for MSW

- *Additional NDC measure 7.1 – WTE plant for Port Vila*
- *Additional NDC measure 7.2 – WTE plant for Luganville*
- *Additional NDC measure 7.3 – WTE plant for Lenakel*

WTE plants in Vanuatu are envisaged to establish a sustainable solid waste management (SWM) system for the municipal areas of Port Vila, Luganville and Lenakel and their neighbouring outer islands by: (i) developing treatment using proven WTE technology, recycling, and disposal infrastructure; (ii) strengthening institutional capacities for sustainable solid waste service delivery and environmental monitoring; and, (iii) improving public awareness of WTE and reduce-reuse-recycle. The WTE plants will be designed to reduce disaster risk and improve climate change resilience, while creating a cleaner environment and decreasing GHG emissions.

Vanuatu needs a long-term waste management strategy and action plan. Further, a detailed techno-economic feasibility study should be conducted to determine the appropriate capacity of each WTE plant. These plants are also expected to contribute to electrification in grid-connected areas and would improve public and environmental health, especially ocean health.

Additional NDC measure (CE strategy 3.2) - Compost municipal organic waste to produce soil enhancers

Vanuatu's households produce an estimated 27,000 tons of organic waste. In some cities, that represents close to 80 percent of waste volumes. The government has set a target to compost 60 percent of organic waste, which would reduce methane emissions from landfills. Where demand exists for biogas, perhaps as a cooking fuel, anaerobic digestion of the organic waste and, perhaps, human extraction can be prioritized. This option is further discussed as CE strategy 3.3. Small-scale composters can be installed to produce compost at household or community level and used directly in gardens or parks. Alternatively, separate collection of organic fractions can allow for more centralized treatment and compost production. Anaerobic digestion with sludge composting could be used for waste from larger sources, such as industrial facilities.

Practices that demonstrate the value of compost and its ability to produce fresh food can be implemented in schools to create awareness. Coffee grounds can be used to produce champignons or more exclusive types of mushroom or other food products that are currently imported. Demonstrating the value of coffee wastes or grounds could be an appealing showcase project for international business partners that purchase organic coffee from Vanuatu. In some cases, products can be produced for the international market using organic residues, such as green banana paper from Korea and Micronesia. Vanuatu's waste management sector is its largest source of unintentional persistent organic pollutants, mostly through waste burning. Increasing composting could help reduce the volume of waste that is burned.

The GoV could support the adoption of small-scale composting facilities by making composting equipment available. If government policies up to 2030 allow for a residual fraction of plastic waste to remain, it could be collected and used to produce household, farm or community-level composting facilities from recycled plastics. Since such a scheme would probably not be economically viable immediately, international funding based on the GHG emissions avoided could contribute to the financing necessary.

Approximately two-thirds of MSW is organic. Thus, diverting 100 tons of waste from dumping would reduce GHG emissions by 64 tCO_{2e} the following year. The estimates below assume that organic materials equal to 60 percent of organic waste is diverted from landfilling, which would align with the national target to compost 60 percent of organic waste.

Additional NDC measure (CE strategy 3.9) – Collect, sort and export recyclable materials (indicative) for first phase for Port Vila

Vanuatu has one recycling company that collects metals and used oils. There are only small volumes of other materials, such as paper, to be collected and recycled. Because many food products are imported to the islands, the country relies on international suppliers to reduce packaging waste.

Once the volume of packaging materials is minimized, the collection of materials for recycling can provide jobs, while tapping into resources that would otherwise be sent to landfills. To demonstrate the value of recycling, the secondary origin of materials can be made more visible and explicit. Some of the activities around small-scale recycling and artisan repurposing of materials could take place within tourist centres to increase the visibility of this issue and these processes.

The low price for recyclables on international markets for secondary materials has reduced the volumes of these materials that are exported. Import levies on packaging materials and packaged products, perhaps accompanied by a carbon price on avoided GHG emissions when materials are recycled, can help finance the revival and scaling up of their collection, export and recycling.

Between 20 and 100 people collect recyclable waste at Vanuatu's largest landfill site, Bouffa, on any given day. To improve the collection of recyclable materials, Vanuatu could explore developing a digital tool that connects these waste sorters with supply.

A decentralized alternative would involve establishing a facility near the landfill to facilitate the sorting and separation of recyclable materials. Around 25 percent of materials in Nairobi are separated and recycled, creating 1,600 jobs and reducing GHG emissions by diverting waste from landfills. Asia Pacific Waste Consultants has estimated that around 8,520 tons/year of inorganic waste materials can be recycled from waste streams in Vanuatu, excluding plastics. That value assumes a certain recovery rate per item.

The largest fractions that can be recycled are scrapped cars, paper and cardboard, scrap metals, and used motor oils. Secondary or recycled materials have a lower carbon footprint than materials that are extracted and processed as primary materials. By recycling, which often requires exporting these materials to facilities abroad, Vanuatu could reduce GHG emissions in the country of destination by approximately 18,000 tCO_{2e}.

Additional NDC measure (CE strategy 3.10) - National plastics strategy

Vanuatu's goal is to reduce plastics imports by 50 percent by 2030. Import restrictions and duties can be instrumental in achieving that goal. With an import ban on a range of single-use plastics, Vanuatu has begun to restrict the import of products and materials that the country's current waste management system cannot process appropriately. This has encouraged the use of locally available and regenerative alternatives. In addition, the country has imposed import duties on some, but not all, carbon-intensive materials.

The country could extend these restrictions and discourage the import of products that create serious waste problems by, for example, imposing excise duties. Revenues from these duties could be invested in developing of sustainable local alternatives and strengthening waste collection and processing. The latter would constitute an extended producer responsibility (EPR) scheme, which could allow the country to lift restrictions in the future. The duties would also compensate for the low prices for recyclable materials on international markets and cover the costs of reverse logistics and adequate processing in Vanuatu or abroad.

Plastic waste can be reduced further through improved management of plastic products on the islands. Vanuatu has already launched initiatives to price recyclable materials and introduce deposit schemes for plastic packaging.

Improved logistics as part of the Inter-Island Shipping Support Project to improve domestic shipping can provide new opportunities to recover recyclable materials from the outer islands and allow all communities to participate in container deposit and ERP schemes.

Regional collaboration among Pacific islands can help negotiate ERP schemes that support waste collection and recycling and, more importantly, accelerate product or value chain design improvements to avoid plastic waste altogether.

Vanuatu produces an estimated 5,700 tons of plastic waste. Reducing imports by 50 percent could thus reduce upstream emissions from the production of plastic products by approximately 1,700 tCO_{2e}.

6.4.2 WASTEWATER

Domestic and commercial wastewater discharge is another source of GHG emissions (CH_4 and N_2O) in Vanuatu. Because no major industries are active in the country, there are no emissions related to industrial wastewater discharge. Wastewater is generated primarily by sanitation systems and domestic and commercial activity, largely handled by decentralized or open septic systems. Decentralized septic tanks are used for all formal developments in urban areas, along with ventilated improved pit toilets and water-seal pit latrines. Sanitation services in informal housing areas are of very poor quality, polluting the ground and water and posing dangers to human health. Sanitation facilities in rural areas are also of poor quality and include primarily pit latrines or bush toilets. Hotels and the Port Vila hospital have wastewater treatment plants that typically operate beyond their capacity. Septic tank systems allow waste to decompose but the process leaves sludge as a by-product. In urban areas, private service providers remove the residual sludge in tankers and dispose of it at designated sites. Urban and provincial centres lack effective systems to manage sstormwater and runoff.

GHG emissions from the wastewater subsector totalled 7.304 $GgCO_{2e}$ in 2010 and rose to 7.654 $GgCO_{2e}$ in 2015. This subsector is responsible for around 22.16 percent of the waste sector's GHG emissions and less than 1 percent of Vanuatu's total GHG emissions. Lacking an adequate waste water management system, GHG emissions from this subsector are increasing due to population growth and urbanization. Apart from these emissions, wastewater poses serious health and environmental risks. Uncontrolled nutrient discharges, nitrates and phosphates from sewage, septic outflows, siltation and industrial waste, combined with poor natural flushing, are more serious public health concerns than bacterial contamination. In 2017, a sewage treatment facility was installed in Port Vila to deal with waste disposal from septic tanks.

The wastewater management system in Vanuatu could be improved further, particularly in the urban areas of Port Vila, Luganville and Lenakel.

Additional NDC measure 8 – Wastewater management system in Vanuatu

- *Additional NDC measure 8.1- Centralized wastewater collection and treatment system in municipal areas, including awareness and capacity-building*
- *Additional NDC measure 8.2 - Improvements to public and communal toilet facilities, including bio-toilets*

A further detailed techno-economic feasibility assessment is required to understand the direct and indirect GHG emissions reduction potential based on the proposed actions.

6.4.2.1 Waste sector - GHG emissions scenarios

GHG emissions scenario has been developed for the waste sector, including the subsectors discussed above. The scenarios are based on historical emissions, with projections for the period 2010-2030 made using the statistical model. Three scenarios have been developed:

- **BAU scenario or WOM:** Assessment based on what might happen if Vanuatu takes (or has taken) no action (WOM).
- **NDC scenario or WEM:** Assessment based on what might be achieved with the actions that Vanuatu is committed to take under the existing NDC (WEM or, sometimes, simply known as WM).

The existing NDC does not include targets for the waste sector. Thus, there is no difference between the BAU and WEM scenarios.

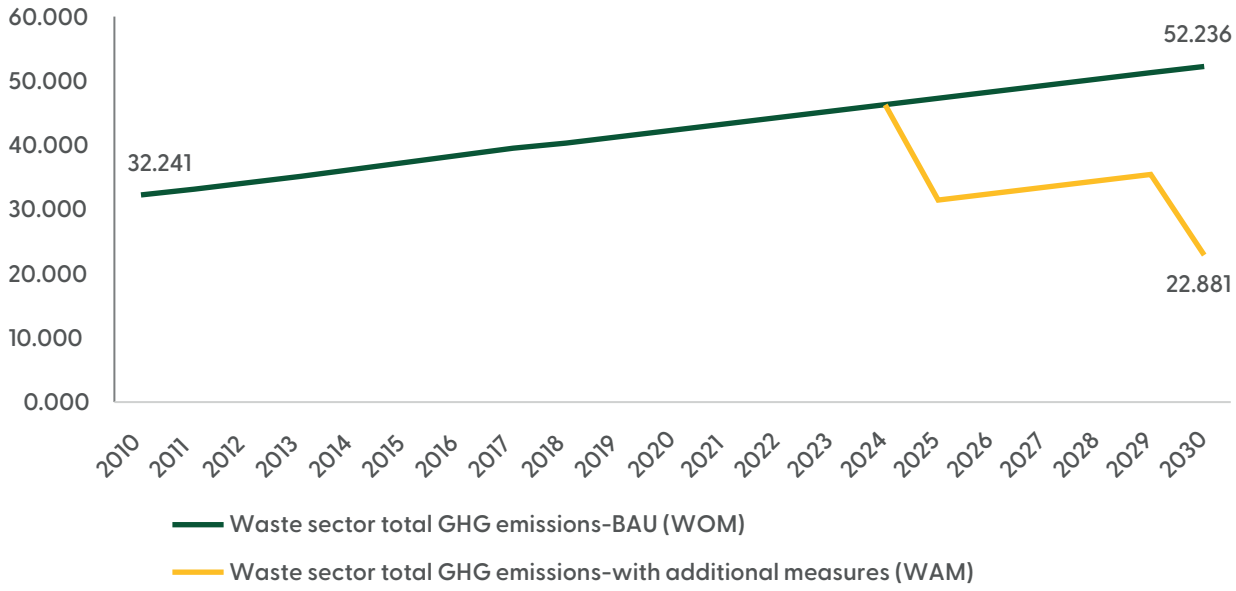
- **Enhanced NDC scenario or WAM:** Assessment based on additional measures identified and to be included as enhanced NDC actions; e.g., what else Vanuatu could do to further enhance the climate change-related ambitions (WAM).

Table 16 presents the additional measures recommended for the waste sector (including the subsectors).

Table 16: Additional waste sector NDC measures (proposed actions) (2030)

Waste sector	
Solid waste	
Additional NDC measure 7	WTE plant for MSW
Additional NDC measure 7.1	WTE plant for Port Vila
Additional NDC measure 7.2	WTE plant for Luganville
Additional NDC measure 7.3	WTE plant for Lenakel
Additional NDC measure (CE strategy 3.2)	Compost municipal organic waste to produce soil enhancer
Additional NDC measure (CE strategy 3.9)	Collect, sort and export recyclable materials (indicative) for first phase for Port Vila
Additional NDC measure (CE strategy 3.10)	National plastics strategy
Wastewater	
Additional NDC measure 8	Wastewater management system in Vanuatu
Additional NDC measure 8.1	Install centralized wastewater collection and treatment system in municipal areas
Additional NDC measure 8.2	Make improvements to public and communal toilet facilities, including bio-toilets

Figure 35: Waste sector GHG emissions scenario – WAM (2030) (Gg CO_{2eq})



The waste sector GHG scenario analysis shows the following:

- **GHG emissions under BAU scenario or WOM:** Waste sector net GHG emissions (CO_{2eq}) under the BAU scenario are estimated to reach 52.236 Gg in 2030.
- **GHG emissions under existing NDC scenario or WEM:** The existing NDC did not include mitigation actions for the waste sector; thus, emissions are expected to remain the same as under the BAU scenario.
- **GHG emissions under enhanced NDC scenario or WAM:** With the additional NDC measures presented above, the waste sector's net GHG emissions (CO_{2eq}) would total around 22.881 Gg CO_{2eq} in 2030. This is approximately 56 percent (29.335 Gg CO_{2e}) less than under the BAU scenario. (The GHG mitigation potentials for some of the additional enhanced NDC measures for the waste sector have not been estimated given the complexity of the data and lack of a defined methodology. However, the cumulative impact of the additional measure will produce greater GHG emission reductions from the waste sector.)

7. RECOMMENDED OPTIONS FOR NDC UPDATE AND INCREASING AMBITION

A GHG emissions scenario has been developed for relevant GHG emission sectors for Vanuatu (energy, AFOLU and waste, including the subsectors discussed above). The scenarios are based on historical emissions, with projections for 2010-2030 made using the statistical model. Three scenarios have been developed:

- **BAU scenario or WOM:** Assessment based on what might happen if Vanuatu takes (or has taken) no action (WOM).
- **NDC scenario or 'with existing measures' (WEM):** Assessment based on what might be achieved with the actions Vanuatu is committed to take under the existing NDC ((WEM) or, sometimes, simply known as WM).

Table 17: Vanuatu Existing – NDC Measures by 2030

Energy Industry (Electricity Generation)	
NDC Action 1 (Existing measure1):	Renewable energy capacity addition
NDC Action 2 (Existing measure2):	Substituting and/or replacing fossil fuels with coconut (copra) oil-based electricity generation
Transport	
NDC Action 3 (Existing measure3):	Improve transport (land and marine) energy efficiency

- **Enhanced NDC scenario or WAM:** Assessment based on additional measures identified and to be included as enhanced NDC actions; e.g., what else Vanuatu could do to further enhance the climate change-related ambitions (WAM).

Table 18 presents the additional measures recommended for the waste sector (including the subsectors), net GHG emissions from each additional measure and tentative additional costs.

Table 18: Vanuatu's Existing NDC Measures with additional measures by 2030

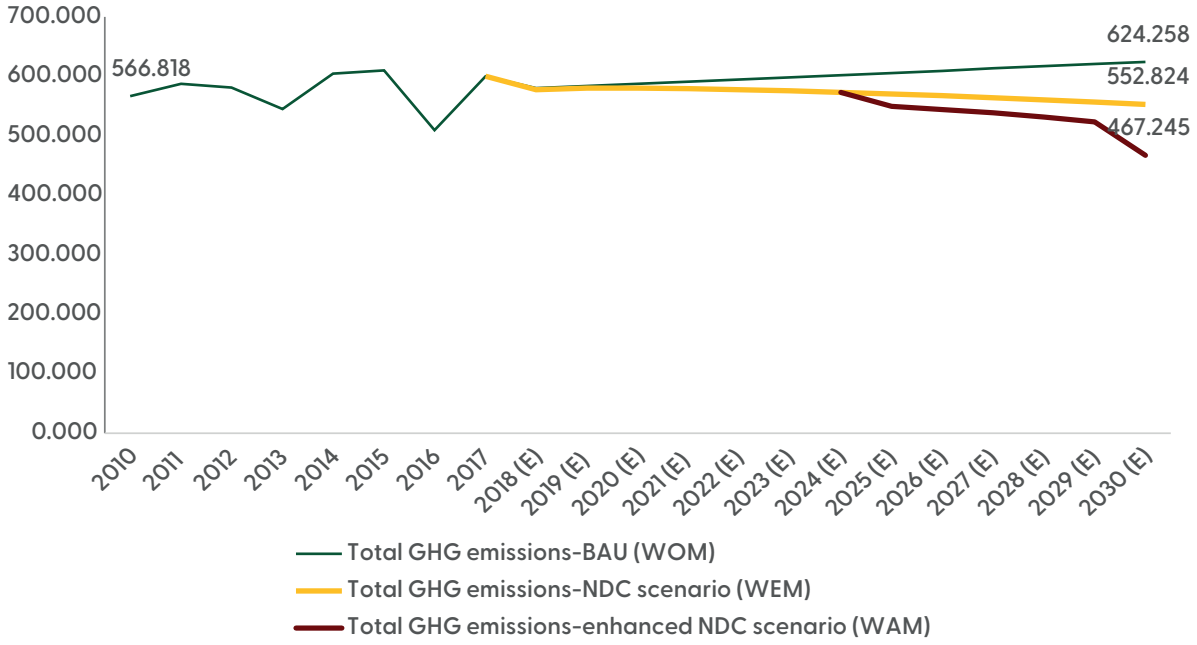
GHG emissions sector NDC actions (existing and enhanced NDC scenario)		GHG mitigation	Estimated additional costs
		Gg CO_{2e}/year	Million $
Energy industry (electricity generation)			
NDC Action 1 (Existing measure 1)	Add RE capacity	61.57	Already budgeted under NERM
NDC Action 2 (Existing measure 2)	Substitute and/or replace fossil fuels with coconut (copra) oil-based electricity generation		
Transport			
NDC Action 3 (Existing measure 3)	Improve transport (land and marine) energy efficiency	9.86	Already budgeted under NERM
Additional NDC measure 1	Electric vehicles (e-mobility)	2.61	4.25
Additional NDC measure 1.1	Electric vehicles (e-buses) for public transportation (10% of total public buses)	1.84	2.50
Additional NDC measure 1.2	Electric cars (e-cars) in Vanuatu (10% of government fleet)	0.08	1.00
Additional NDC measure 1.3	1,000 electric two (e-bikes)/ three-wheelers (e-rickshaw)	0.68	0.75
Additional NDC measure 2	20% biodiesel (biofuel) blending in diesel	18.50	1.25
Additional NDC measure 3	Vehicle mileage and emissions standards	0.29	0.50
Other sectors			
Additional NDC measure 4	Biogas plants for commercial and residential use (1,000 plants)	3.50	10.00
Additional NDC measure 5	Energy efficiency in commercial and residential sector	0.35	0.75
Additional NDC measure 5.1	Increase energy efficiency in commercial and residential sector by 5%	0.35	0.25
Additional NDC measure 5.2	10 energy-efficient buildings (green buildings)	NE	0.50
Additional NDC measure (CE strategy 3.15)	Ecotourism supported by local communities	NE	0.25
IPPU sector NDC actions - Not applicable/not included			
AFOLU sector NDC actions			
Agriculture - Not applicable/not included			
Livestock			

GHG emissions sector NDC actions (existing and enhanced NDC scenario)		GHG mitigation	Estimated additional costs
		Gg CO_{2e}/year	Million $
Additional NDC measure 6	Training and capacity-building for livestock farming and pasture management	NE	0.35
Additional NDC measure (CE strategy 3.1)	Converting pastures to silvopastoral livestock systems	30.98	0.50
Additional NDC measure (CE strategy 3.14)	International collaboration to improve livestock efficiency	NE	0.50
Forests - Not included			
Waste sector			
Solid waste *			
Additional NDC measure 7	WTE plant for MSW	14.85	100.00
Additional NDC measure 7.1	WTE plant for Port Vila	14.27	55.00
Additional NDC measure 7.2	WTE plant for Luganville	0.50	30.00
Additional NDC measure 7.3	WTE plant for Lenakel	0.08	15.00
Additional NDC measure (CE strategy 3.2)	Compost municipal organic waste to produce soil enhancer	10.94	1.50
Additional NDC measure (CE strategy 3.9)	Collect, sort and export recyclable materials (indicative) for first phase for Port Vila	NE	1.00
Additional NDC measure (CE strategy 3.10)	National plastics strategy	NE	0.25
Wastewater			
Additional NDC measure 8	Wastewater management system in Vanuatu	3.57	52.50
Additional NDC measure 8.1	Centralized wastewater collection and treatment system in municipal areas, including awareness and capacity-building	1.07	50.00
Additional NDC measure 8.2	Improvements to public and communal toilet facilities including bio-toilets	2.50	2.50
	Total	157.01	173.60

Note: NE=Not estimated

The graph in Figure 36 presents Vanuatu's GHG emissions scenarios to 2030.

Figure 36: Vanuatu GHG emissions scenario/WAM (2030) (Gg CO_{2eq})



The GHG scenario analysis shows the following:

- **GHG emissions under BAU scenario or WOM:** Net GHG emissions (CO_{2eq}) under the BAU scenario (if Vanuatu takes, or has taken no action ((WOM)) would reach 624.258 Gg in 2030.
- **GHG emissions under existing NDC scenario or WEM:** Net GHG emissions (CO_{2eq}) might be 552.824 Gg in 2030 with actions that Vanuatu has already committed to under the existing NDC (WEM or WM). GHG emissions WEM are approximately 11 percent (71.434 Gg CO_{2e}) less than under the BAU scenario.
- **GHG emissions under enhanced NDC scenario or WAM:** Net GHG emissions (CO_{2eq}) will be around 467.245 Gg CO_{2eq} in 2030 with additional measures identified and to be included as enhanced NDC actions (that is, additional actions that Vanuatu will take to further enhance its climate change-related ambitions (WAM). GHG emissions WAM total around 25 percent (157.013 Gg CO_{2e}) less than under the BAU scenario; in addition, the estimated investment would be around $173.60 million.

In addition:

- Similar to the conditional targets under the current NDC, all recommended additional measures/ targets under the enhanced NDC submission would be conditional on receiving sufficient funding from external sources to implement the transition.
- The costs for existing NDC measures (NDC Actions 1, 2 and 3 (Existing measures 1, 2 and 3)) have not been included in this report because they are already budgeted under the current NDC implementation road map, NERM:2016-2030. The costs of additional measures are estimates based on similar international examples and best practices, inputs from relevant sectoral expertise and other assumptions. Vanuatu intends to develop a detailed implementation road map for the updated NDC, which would involve a detailed techno-economic analysis of the additional interventions. The road map is expected to provide a firm cost estimate for achieving the GHG targets.
- The recommendations and related estimated emission reductions are based on the realistic NDC enhancement goals that the GoV intends to consider and commit to under the PA.

- Additional opportunities exist to further increase the ambition (for example, by increasing the number of e-vehicles or number of waste treatment plants). However, the GoV intends to take a precautionary approach that would involve assessing the results of the enhanced NDC interventions and further revising the targets considered during the 2025 NDC update.
- Although livestock is the most GHG-intensive sector in Vanuatu, it contributes significantly to Vanuatu's economy. Any interventions to mitigate/reduce emissions from the livestock sector could be economically and politically sensitive. Consequently, mitigating emissions from the livestock sector has not been considered under the NDC update.

8. MONITORING, REPORTING AND VERIFICATION (MRV) FRAMEWORK[20]

The GoV has developed and implemented an integrated MRV tool for the energy sector and an MRV tool for the NERM 2016-2030. (The scope of the energy sector tool is being expanded to cover additional mitigation sectors, in accordance with the updated NDC.)

8.1 VANUATU'S INTEGRATED MRV TOOL

Vanuatu's integrated MRV tool is a first-of-its kind initiative to integrate most domestic and international climate action monitoring, tracking and reporting requirements. Further, it supports government agencies, development partners and NGOs in making evidence-based decisions and data insights reporting. The tool has been customized to track, monitor and report data critical to climate action and the SDGs.

Vanuatu's tool is a web-based system that includes a detailed online database for IPCC sectors and climate actions. Key features and modules include:

Module 1: GHG inventory

Module 2: Mitigation

Module 3: Adaptation

Module 4: Climate finance

Module 5: SDGs

In addition to the above modules, crosscutting issues - human rights and gender-responsive climate change actions and protection of vulnerable groups - have been included in the SDG, mitigation and adaptation modules. Further, each module has the following key features:

- Means to generate, record, store, aggregate, collate and report data on the parameters monitored;
- Data sources, measurement methods and procedures and data-sharing protocols, including the frequency of monitoring/recording;
- Procedures for reporting by both public institutions (national and county levels) and private entities;
- Linkages to SDGs and gender-responsive indicators; and,
- QA/QC procedures.

The purpose of the tool is to assist the DoCC and other line ministries/departments to develop a concise and strategic domestic national MRV system to enhance monitoring, tracking, reporting and verification of climate actions, including GHG emissions, mitigation, adaptation and SDG impact of projects, programme and policies and international, regional and domestic public and private climate finance flows.

20 https://www.ndcs.undp.org/content/ndc-support-programme/en/home/impact-and-learning/library/vanuatu-integrated-mrv-tool0.html#:~:text=The%20integrated%20MRV%20tool%20is,Action%20Impact%20Tool%2DCAIT).

MODULE1: GHG INVENTORY

The national GHG inventory is typically an annual inventory of anthropogenic emissions by sources and removals by sinks of GHGs not controlled by the Montreal Protocol. Its objective is to communicate and report on those emissions and removals from four main sectors: energy, IPPU, AFOLU and waste.

This module is based on the IPCC National Greenhouse Gas Inventory Tool and emission calculation templates. Its purpose is to customize the IPCC inventory tool based on Vanuatu's specific requirements and to make it more user friendly and resource efficient. The module will implement Tier 1 methodologies in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories for preparing national GHG inventories according to the 2006 IPCC Guidelines, either for complete inventories or separate categories or groups of categories. The module's basic approach is to facilitate completing the 2006 IPCC Guidelines category worksheets, entering activity and emission factor data. In addition, it also supports many other functions related to database administration, quality control, data compilation and data reporting.

MODULE 2: MITIGATION

Monitoring and tracking national climate change mitigation actions is an important aspect of the integrated MRV tool. The rationale for introducing this module under an integrated MRV is to be able to regularly update policy/decision makers, project implementers, managers and stakeholders on the status and progress of mitigation actions in Vanuatu. The inventory provides an overall picture of total past emissions, while the mitigation action tracker provides information on progress toward meeting the NDC/non-NDC commitments, including verifying GHG reduction impact, policy successes or gaps, and actions taken towards GHG mitigation.

International accounting guidelines and NDC mitigation action reporting requirements have yet to be formulated under the PA. However, the agreement provides important information to national-level policy makers to track actions towards achieving the NDC commitments. The NDC mitigation action tracker demonstrates the progressive approach of Vanuatu's integrated MRV tool and further strengthens Vanuatu's commitment to achieving NDC targets.

The mitigation action tracking module focuses on both project implementation and operations phases.

MODULE 3: ADAPTATION

The climate change adaptation action monitoring and tracking module has been designed in keeping with the UNDP Climate Action Impact Tool (CAIT) Tool. It will also incorporate the monitoring and evaluation and reporting requirements defined under the NSDP. The adaptation action tracking tool also takes a similar bottom-up approach to and uses the methodology proposed for mitigation action tracking and follows the same key steps as the climate change mitigation action tracking. The adaptation module includes both qualitative and quantitative information. The adaptation actions (projects or programmes) can be monitored, reported and communicated via analysis, project fact sheet and other methods.

MODULE 4: CLIMATE FINANCE

The climate finance module is designed to monitor and track financial inflows into Vanuatu for climate actions (mitigation and adaptation) and disbursement of climate finance/expenditures. The PA has given due importance to international and domestic financial flows for climate change mitigation and adaptation. Further, while the transparency framework under the PA highlights key requirements such as monitoring and reporting and common modalities and procedures, detailed guidelines are not yet final. The integrated MRV tool considers tracking international financial and technology support (provision, received and impact of support) for implementation of GHG mitigation actions, training and capacity-building.

Two-pronged (top down and bottom up) approaches are being considered for the climate finance flow tracking tool, which includes international and domestic financial flows used to implement the NDC commitments and achieve the climate change and interlinked SDGs to be monitored, reported and communicated. The module enables financial tracking of policies, programmes and projects.

MODULE 5: SUSTAINABLE DEVELOPMENT GOALS (SDGS)

The SDG module is based on the SDG tool developed by the UNDP-UNDP CAIT Tool. However, it has been tailored to Vanuatu's specific requirements, considering the local context and the capacity/resources available.

This module provides guidance for MRV and data collection to align the efforts with national reporting requirements to the UNFCCC for NDCs and to track progress made toward achieving the SDGs. The SDG module helps to manage the design, development, implementation, financing, measurement, reporting and verification of the actions. It makes it possible to identify significant impacts, define indicators, quantify impacts, set targets and track the progress of the actions towards the NDCs. It is a bottom-up tool that can be applied to track the actions and significant direct impacts.

The reports generated using the MRV tool are subject to internal and external verification on a periodic basis (or as and when required).

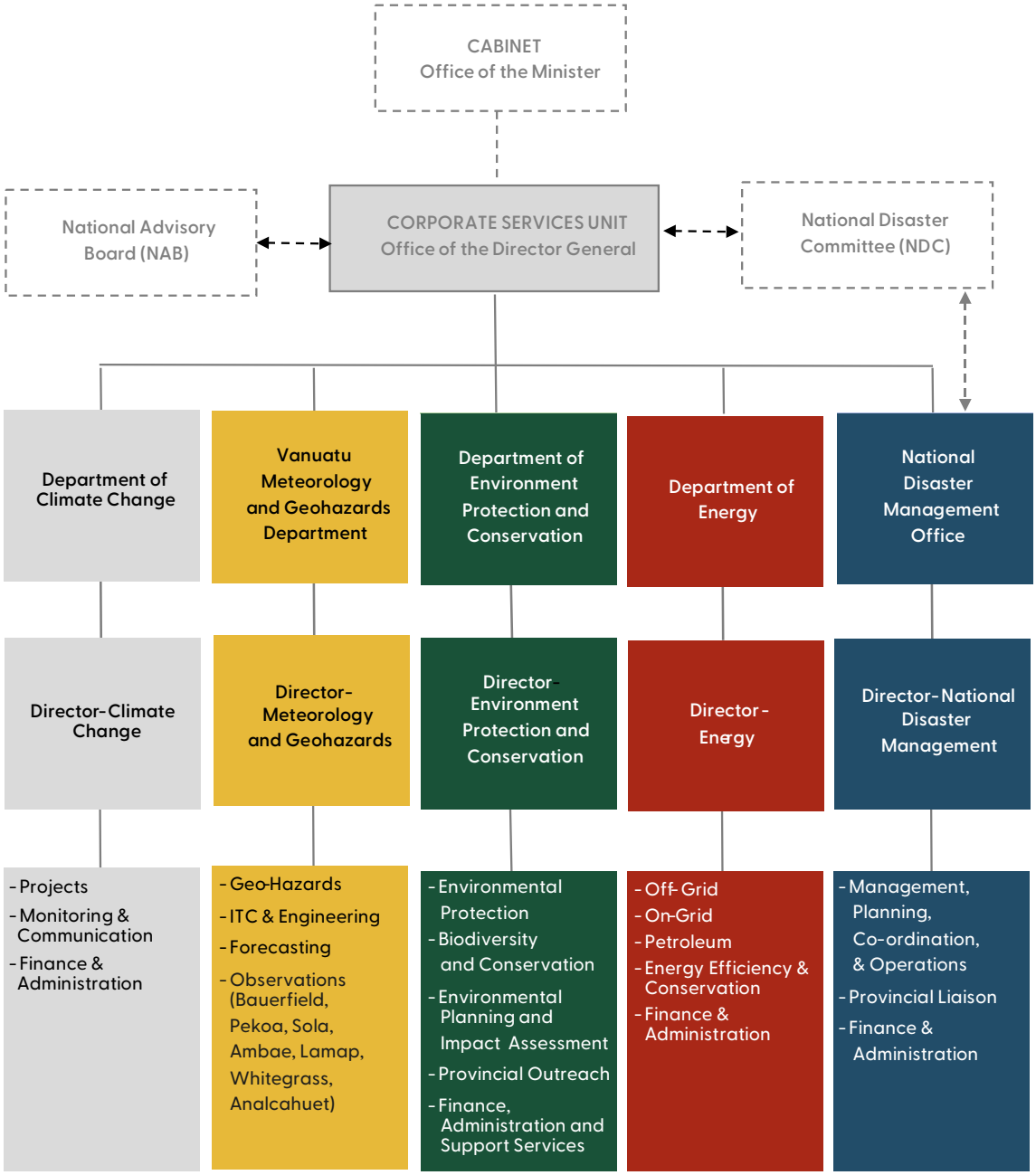
9. MEANS OF IMPLEMENTATION

9.1 INSTITUTIONAL ARRANGEMENT

MINISTRY OF CLIMATE CHANGE

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. This Ministry is the youngest in the Government. It was created in 2014 to strategically align the departments responsible for those three efforts. 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. Figure 37 presents the ministry's organizational and institutional structure.

Figure 37: Ministry of Climate Change organizational structure



The Ministry includes the VMGD, the National Disaster Management Office (NDMO), the DoE, the Department of Environment and the Project Management Unit. The Ministry and the NAB are charged with coordinating all government and non-government initiatives addressing climate change and disaster risk reduction 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. It was established and its mission defined in the Climate Change Act.

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

NATIONAL ADVISORY BOARD (NAB)

The NAB is composed of government and non-government members. Its primary purpose is to: "act as Vanuatu's supreme policy making and advisory body for all disaster risk reduction and climate change programmes, projects, initiatives and activities[21]." As such, it is the main government stakeholder in the proposed NAMA.

The NAB is co-chaired by the director of the VMGD and the director of the NDMO. Members include senior-level representatives from key sectoral government agencies and NGO representatives, including a representative of the Vanuatu Humanitarian Team network, the Vanuatu Climate Adaptation Network and the Vanuatu Association of Non-Governmental Associations. Members are nominated, in the first instance, by the directors of the VMGD and the NDMO at an official NAB meeting.

DEPARTMENT OF CLIMATE CHANGE (DOCC)

The GoV established the DoCC within the MoCC. The DoCC is mandated to: ensure that high-quality climate change-related services are provided in Vanuatu; promote capacities of governments, communities and organizations to understand and respond to risks arising from climate change; and, ensure that the government and the public are informed of matters related to climate change and are able to make effective use of such information and data to respond to such events in order to protect the environment and the safety and welfare of the community.

DoCC is responsible for coordinating all of Vanuatu's climate change-related programmes and projects and aligning the climate change initiatives with development strategies, including the annual and medium-term government budgets. It is also responsible to ensure that climate change programmes and projects are carried out within specified timeframes and that activities meet the necessary public participation and stakeholder requirements. The DoCC is also authorized to act as a Financial Management Agent for externally funded programmes and projects and, thus, will be responsible for project financial management and administration on behalf of the NAB and the Ministry.

DEPARTMENT OF ENERGY (DOE)

The DOE is responsible for energy sector planning and administration and has long had a key role in assessing rural energy resources, identifying rural energy supply projects, and developing and implementing these projects, which are nearly always donor funded.

> The DoE works closely with DoCC to develop projects and manage donor funds as it is authorized to act as a Financial Management Agent for externally funded programmes and projects on behalf of the Ministry.

21 https://www.nab.vu/about

UTILITIES REGULATORY AUTHORITY (URA)

The URA, established in 2008, provides oversight of electricity supply in concession supply areas (concessions currently held by UNELCO and VUI), is responsible for provision by utilities of safe, reliable and affordable electricity (and water) services, deals with consumer complaints, and advises the government on electricity-related matters.

OTHER MINISTRIES

The Ministry of Infrastructure and Public Utilities is responsible for all of the government's public infrastructure. The Ministries of Education and Health have been involved in providing small solar PV systems for remote schools and health centres. The Ministry of Finance will be involved in any arrangements for financing remote energy systems.

POWER UTILITIES – PRIVATE SECTOR

UNELCO and VUI are the key economic players in Vanuatu's utilities sector. Both are private sector enterprises and the utilities concessionaire for the production, transport and supply of electricity and water in their respective concession areas.

UNELCO holds one geographical concession - Efate island - for the provision of electricity, and the capital, Port Vila, for the supply of water. The electricity concession involved a complete takeover of the utility, including, but not limited to, operation and maintenance of the power generation plants, transmission and distribution, substation, customer service and billing, meter readings, extensions and expansion.

VUI is a wholly-owned subsidiary of Pernix Group Inc. and has a memorandum of understanding with the GoV for the Luganville Electricity Concession on the island of Espiritu Santo. This concession involved a complete takeover of the utility, including, but not limited to, operation and maintenance of the hydro and diesel generation plants, transmission and distribution, substation, customer service and billing, meter readings, extensions and expansion.

UNELCO and VUI are the only two private sector power utilities operating in Vanuatu inside their concession areas.

NON-GOVERNMENTAL ORGANIZATIONS AND OTHER PRIVATE SECTOR SERVICE PROVIDERS

Several local and regional NGOs have been involved in implementing remote energy projects (for example, VANREPA, IUCN and ACTIV), and some could have a role in providing equipment and/or managing RE systems, as could locally companies. About five years ago, a now-discontinued Australian assistance programme (Vanuatu Electrification for Rural Development) identified 11 potential renewable energy service companies that could be involved in remote electrification: Cloud Zero Power Supplies, Energy 4 All, GreenTech, Jem Solar, Pacific Power Products, Solar Communication, VanGlobal, VANREPA, Vanuatu Son Solar, Vate Electrics and White Sand Engineering. At the time, each had an average of five employees and were all headquartered in Port Vila. VANREPA is apparently now inactive but some of the others are still operating.

ANNEX 1 – QUALITY ASSURANCE CHECKLIST FOR REVISING NATIONALLY DETERMINED CONTRIBUTIONS (NDCS)

The checklist outlines three dimensions that UNDP considers essential for ambitious and robust NDCs:

1. **Country ownership and inclusiveness:** the engagement of political and societal stakeholders at all levels during the revision process and the inclusion of engagement outcomes in the NDC.

2. **Robustness and ambition:** the clarity, transparency, and understanding of mitigation and/or adaptation components, cross-cutting issues communicated in the revised NDCs, and the progression made in key targets and measures.

3. **Feasibility:** key enabling conditions for implementing NDCs, i.e., finance mobilization, technology transfer and institutional capacity building.

DIMENSION ONE: COUNTRY OWNERSHIP AND INCLUSIVENESS

This section focuses on efforts to strengthen country ownership through an inclusive engagement process, taking a whole-of-government approach, and engaging across society in the design and implementation of the revised NDC. Key considerations include:

	Included	Partially included	Not included
Have the key ministries, departments and agencies of government played an active role in revising the NDC?	☑	○	○
Have different government institutions from relevant sectors, at both the national and sub-national levels, been engaged and consulted on the NDC revision?	☑	○	○
Have private sector, civil society organizations, academia, vulnerable and marginalized groups, and other relevant stakeholders, been meaningfully engaged and consulted on the NDC revision? Has this engagement taken place at both the national and sub-national levels?	☑	○	○
Does the NDC include information on gender-responsive considerations (e.g. gender analysis[1])?	☑	○	○
Does the NDC include information on youth-specific needs and roles?	☑	○	○
Does the NDC identify steps for an inclusive, just transition of the workforce?	☑	○	○
Does the NDC include information related to vulnerable groups (e.g. those highly impacted by climate and natural hazards, women, children, elderly, disabled and indigenous people, etc.)?	☑	○	○
Does the NDC include targeted awareness-raising, advocacy and education related activities?	☑	○	○

DIMENSION TWO: ROBUSTNESS AND AMBITION

This section examines whether the revised NDC is robust and applies guidance for the "information for clarity, transparency, and understanding ", in accordance with the Paris COP[2] decision and further decisions of the CMA[3]. This section also assists countries in communicating specific targets and measures in their revised NDCs and indicating how they compare to the previous NDCs – addressing increased mitigation ambition and enhanced adaptation component. An **enhanced transparency framework (ETF)** was established and countries are currently transitioning from the existing measurement, reporting and verification (MRV) system to the ETF. Therefore, the following guiding questions might also be helpful for countries to consider how to meet reporting obligations under the ETF, along with the NDC revision process. Key considerations include:

2.1 MITIGATION

2.1.1 Robustness

	Included	Partially included	Not included
Does the NDC include information elements identified in **Decision 4/ CMA.1**? (reference point, baseline, etc.)	☑	○	○
Has quality assurance and quality control of data, methodologies, and other relevant information when revising the NDC (e.g. technical review) been carried out?	☑	○	○
Does the NDC revision process consider the improvement of tracking progress made in implementing and achieving its NDC (e.g. identify the indicators that it selected to track progress, date availability, national institutional arrangements,)?	☑	○	○

2.1.2 Ambition and Progression

	Included	Partially included	Not included
Does the NDC update and/or add new quantified GHG target(s)? (e.g., converted a target based on non-GHG metric to a GHG target)	☑	○	○
Does the NDC increase the ambition of previous sectoral non-GHG target (s) (e.g., 50% renewable energy to 80%)	☑	○	○
Does the NDC include updated or add new qualitative targets/ measures compared to the previous NDC?	☑	○	○
Does the NDC increase the **geographical coverage** since the previous NDC and cover the entire geography of the country?	○	○	☑
Does the NDC increase the **sectoral coverage** since the previous NDC and cover **all sectors** (as defined by the IPCC)?	☑	○	○

2 COP: Conference of the Parties
3 CMA: Conference of the Parties serving as the meeting of the Parties to the Paris Agreement

	Included	Partially included	Not included
Does the NDC increase **GHG coverage** since its previous NDC and cover **all gases** (as defined by the IPCC)?	☑	○	○
Has the NDC increase the scope of **unconditionality** component of its mitigation targets compared to its previous NDC?	○	○	☑
Is the NDC based on updated or new information on relevant sectoral trends? Does the NDC identify relevant sectoral or development priorities, strategies, policies, or plans?	☑	○	○
Does the NDC align measures and priorities with longer-term mitigation strategies?	☑	○	○

2.2 ADAPTATION

2.1.1 Robustness

	Included	Partially included	Not included
Does the NDC include information elements identified in **Decision 9/CMA.1** ?	○	☑	○
Does the NDC identify national adaptation priorities, strategies, policies, or plans (e.g. targets/measures aligned with the preparation of NAPs)?	○	○	☑
Does the NDC align measures and priorities with national disaster risk reduction/management and humanitarian response strategies and plans?	○	○	☑
Does the NDC consider the improvement of monitoring and evaluation for adaptation measures?	☑	○	○

2.2.2 Enhancement

	Included	Partially included	Not included
Does the NDC include new or updated information on climate change impacts, risks, or vulnerabilities (e.g., climate and/or disaster risk and vulnerability assessments, scenarios of future trends)?	○	○	☑
Does the NDC increase the **geographical coverage** of adaptation activities since the previous NDC?	○	○	☑
Does the NDC increase the **sectoral coverage** of adaptation activities since the previous NDC?	○	○	☑

2.3 CROSS-CUTTING ISSUES

	Included	Partially included	Not included
Does the NDC align with national, sectoral, and/or sub-national development strategies/plans, including the SDG implementation plan/roadmap?	☑	○	○
Have the socio-economic impacts of NDC targets and measures been considered?	☑	○	○
Does the NDC revision process consider the improvement of an MRV system related to SDGs and other cross-cutting issues? (e.g. indicators, parameters, baseline, and project targets highlight impacts on vulnerable groups, youth, women, children, etc.)	☑	○	○
Does the NDC revision process consider the improvement of an MRV system for financial support?	☑	○	○

DIMENSION THREE: FEASIBILITY

This section aims to provide guidance to determine whether the NDC revision process has undertaken assessments of costs benefits, financing options (e.g. domestic public funds, international funding), and investment opportunities of NDC actions both international and domestic public and private sources. This section also facilitates countries to assess governments' institutional, human and technological capacity required for successful NDC implementation.

3.1 FINANCE, COSTS, AND INVESTMENT

	Included	Partially included	Not included
Does the NDC include information on the costs of achieving GHG targets, non-GHG targets, and adaptation policies or actions?	○	☑	○
Does the NDC include information on the costs of climate inaction?	○	○	☑
Does the NDC include information on the **financial strategy** for achieving targets or implementing specific policies or actions (e.g., mainstreaming climate into national, sectoral, and/or sub-national budgets)?	○	☑	○
Does the NDC include information on NDC-related **financial mechanisms** established or being developed (e.g., national climate funds, green bonds)?	○	☑	○
Does the NDC indicate detailed international grant and/or loan support?	○	☑	○

	Included	Partially included	Not included
Does the NDC indicate **public funding sources** for reaching identified targets and goals?	☑	○	○
Does the NDC indicate options to leverage existing or potential (local, regional or international) **private sector investments** for reaching identified targets and goals?	○	☑	○
Does the NDC describe measures that are planned or being implemented to reduce investor risks and/or remove barriers to finance?	○	○	☑

3.2 INSTITUTIONAL ARRANGEMENT AND CAPACITIES FOR IMPLEMENTATION

	Included	Partially included	Not included
Does the NDC include information on **institutional arrangements** with clear roles and responsibilities for NDC implementation across key sectors and different levels of government structure?	☑	○	○
Does the NDC describe capacity development efforts for government officials and other stakeholders?	☑	○	○
Are the targets/measures within the NDC supported by national legislation and/or relevant legal frameworks?	☑	○	○
Does the NDC revision process identify policy, legal and regulatory gaps?	○	☑	○
Does the NDC include policy recommendations or potential solutions to address policy/legal/regulatory gaps?	○	○	☑
Does the NDC include information on technical assistance needs either in terms of human resources or technologies?	○	☑	○

ANNEX 2 – METABOLIC ASSESSMENT CIRCULAR ECONOMY (CE) STRATEGY RECOMMENDATIONS

Metabolic assessment recommendations		Domestic GHG mitigation	International GHG mitigation	Costs	Solid waste avoided
		tCO_{2e}/Year	tCO_{2e}/Year		tons/year
CE strategy 3.1*	Convert pastures to silvopastoral livestock systems	30 977	0	Low	NA
CE strategy 3.2*	Compost municipal organic waste to produce soil enhancer	10,943	0	Medium	16,176
CE strategy 3.3	Wood-based construction in the residential and tourism sectors	8,366	11272	Medium	0
CE strategy 3.4	Align the tax regime with sustainable development ambitions	5,180	1693	Low	0
CE strategy 3.5	Community-based or smallholder biogas systems made from waste plastics	3,500	NA	Medium	962
CE strategy 3.6	Circular procurement by government and development partners	910	910	Medium	0
CE strategy 3.7	Conservation agriculture to optimize soil carbon	827	0	Low	NA
CE strategy 3.8	Non-toxic, antifouling based on biomimicry	577	374	High	0
CE strategy 3.9*	Collect, sort and export recyclable materials	NA	18,717	High	8,520
CE strategy 3.10*	National plastics strategy	NA	2479	High	,2850
CE strategy 3.11	Regional organic certification to cater exports and tourism	NA	213	Medium	52
CE strategy 3.12	Artisan plastics recycling and repurposing	NA	26	Low	12
CE strategy 3.13	Circular fish value chain	NA	NA	High	NA
CE strategy 3.14*	International collaboration to improve livestock efficiency	NA	NA	High	NA
CE strategy 3.15*	Ecotourism supported by local communities	NA	NA	Low	NA
CE strategy 3.16	Agroforestry and food forests	NA	NA	Medium	NA
CE strategy 3.17	Excess materials marketplace and urban mining	NA	NA	Low	NA
Total GHG emissions		**61,280**	**35,684**		**28,572**

* Metabolic assessment recommendation included for NDC enhancement

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